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Water Governance in the Lerma-Chapala Basin of Mexico: A Shift from State-centred to a Multi-stakeholder Approach?

Luis F. Silva Jimenez, *The University of Western Ontario*

Supervisor: Dan Shrubsole, *The University of Western Ontario*

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Abstract

The purpose of this dissertation is to develop a framework for assessing water governance by consolidating and refining disparate principles of water governance in the existing research literature. The developed framework is then applied in a case study of the Lerma Chapala basin in Mexico to assess the state of water governance, and identify accomplishments and constraints in the implementation of an effective water governance system. The study conducts a content analysis of primary data collected through semi-structured interviews with multiple stakeholders in the basin (N=51) and secondary data from national water policy documents (N=18).

Overall, the study identified one major achievement and five major constraints in the implementation of water governance in the Lerma-Chapala basin. The achievement pertains to successful stakeholder negotiations that resulted in a treaty for the allocation of scarce surface water resources in the basin; hence, mitigating allocation conflicts. Constraints include (1) the failure of water user representatives to advance issues that pertain to their stakeholder group in the Basin Council, (2) a fragmented approach to water management that hinders the success of programs and activities at the basin level, (3) the persistence of a centralized decision making protocol that neglects local context, among other issues. Overall, the application of the developed framework in a content analysis of policy documents and stakeholder interviews reveals a major disconnect between policy and practice in the Lerma-Chapala's water governance experience.

The dissertation contributes to the existing literature by providing a conceptual framework for assessing water governance systems. The refined set of five meta-principles allows for better conceptualization, and makes it easier to identify policy-practice disconnects and tease out achievements and constraints to water governance. In this sense, the framework could assist in guiding water sector reforms where changes are needed, to improve the water governance system.

Key words: water governance, integrated water resources management, Lerma-Chapala, content analysis, Mexico, assessment framework, water policy, river basin council.

Dedication

To my wife Marcela and to my children Luis Francisco and Ana Sofia,

and to the memory of my mother Victoria Eugenia Carola and my grandmother Victoria.

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List of Abbreviations

English Acronyms	Spanish Acronyms	English and Spanish Names
BCOOR		Basin Council Organization and Operation Rules (Reglas de Organización y Operación de los Consejos de Cuenca).
	COTAS	Technical Groundwater Committee (Comité Técnico de Aguas Subterráneas) and Technical Water Councils (Consejo Técnico de Aguas)
CRBCs		Coordination of River Basin Councils (Coordinación de Consejos de Cuenca)
FWL		Federal Water Law (Ley Federal de Aguas - 1972).
GWP		Global Water Partnership.
IWRM		Integrated Water Resource Management.
LChB		Lerma-Chapala Basin.
LChBC	CCLCh	Lerma Chapala Basin Council (Consejo de Cuenca Lerma Chapala).
MAHR	SARH	Ministry of Agriculture and Hydraulic Resources (Secretaría de Agricultura y Recursos Hidráulicos).
MALRDFF	SAGARPA	Ministry of Agriculture, Livestock, Rural Development, Fisheries and Food (Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación).
MENR	SEMARNAT	Ministry of the Environment and Natural Resources (Secretaría de Medio Ambiente y Recursos Naturales).
MENRF	SEMARNAP	Ministry of the Environment, Natural Resources and Fisheries (Secretaría de Medio Ambiente, Recursos Naturales y Pesca).
MHR	SRH	Ministry of Hydraulic Resources (Secretaría de Recursos Hidráulicos).
MHSPW	SAHOP	Ministry of Human Settlements and Public Works (Secretaría de Asentamientos Humanos y Obras Publicas).
MUDE	SEDUE	Ministry of Urban Development and Ecology (Secretaría de Desarrollo Urbano y Ecología).

English Acronyms	Spanish Acronyms	English and Spanish Names
NIC		National Irrigation Commission (Comisión Nacional de Irrigación)
NWC	CONAGUA	National Water Commission (Comisión Nacional del Agua).
NWL		National Water Law (Ley de Aguas Nacionales).
NWP		National Water Plan or Program (Plan o Programa Nacional Hidráulico).
	PROFEPA	Federal Attorney's Office for Environmental Protection (Procuraduría Federal de Protección al Ambiente)
PRWC	REPDA	Public Registry of Water Concessions (Registro Publico de Derechos de Agua).
RBC		River Basin Council (Consejo de Cuenca).
RBO		River Basin Organization (Organismo de Cuenca).
RNWL		Regulations of the National Water Law (Reglamento a la Ley de Aguas Nacionales).
UN		United Nations
URPPP		Unit for Rural Programs and Public Participation (Unidad de Programas Rurales y Participación Social).

Chapter One

1 Introduction

1.1 Introduction to the study

During the 1990s, there was general consensus among most professional associations, international organizations and national governments with regards to our failure to properly manage water resources (Serageldin, 1995; Falkenmark, 1997; GWP, 2000; Biswas, 2008). The concept of Integrated Water Resources Management (IWRM) emerged from the United Nations Conference on Environment and Development in Rio de Janeiro in 1992 as a solution to existing and foreseeable water management problems. In general terms, Chapter 18 of Agenda 21 describes IWRM as a holistic, integrated and participatory approach to water resource management that considers the catchment and sub-basin as its working unit (UNDSD, 1993). Hence, the implementation of this new paradigm requires new legislation and policy instruments, new administrative structures and procedures, and the redivision of labour and authority (Peña & Solanes, 2003; Aston *et al.*, 2006; Ballweber, 2006). These changes are particularly challenging in middle- and low-income countries (Sajor & Minh Thu, 2009; Agyenim & Gupta, 2012). Encouraged by major international funding, development and aid agencies, many countries have adopted IWRM reforms, which have transformed the way water resources are governed, especially in developing nations. While this strategy has been successful in some jurisdictions, attempts to decentralize control over water resources have failed in other contexts, resulting in the persistence of state-centred top-down approaches to water management that were evident in the 1990s (Agyenim & Gupta, 2012; Oliveira *et al.,* 2012; Hornidge *et al.*, 2013; de Boer *et al.,* 2016).

Existing literature on water management largely recognizes that the present 'water crisis' is often a crisis of governance (GWP, 2000; Rogers, 2002; Rogers & Hall, 2003; WWAP, 2003, 2006, 2015; Biswas & Tortajada, 2010; Varis *et al.,* 2014). The hydrological, technical, scientific, and physical dimensions of water management are essential for solving issues associated with water quality and water quantity. However, many experts agree that at present, the main implementation challenges for water management lie on issues associated with important components of water governance, such as decentralization, regulation, deregulation, privatization, water allocation, equity, policy

development, stakeholder engagement, transparency, accountability, collaboration, and institutional arrangements (Dourojeanni & Jouravlev, 2001; Tortajada, 2001; Solanes & Jouravlev, 2006; Mehan, 2010). For example, Tropp (2007) and Mitchell (2013) have emphasised that water governance strategies will determine the ability of jurisdictions to effectively apply technical and scientific aspects of water management that are necessary for solving water related problems and consequently, creating effective functioning water infrastructure and deliver services. In the words of Mitchell (2013:143), governance is "a key component for successful water management".

The broad scope of water governance research has resulted in the development of diverse assessment frameworks. The multifaceted nature of water governance research is largely a result of researchers approaching water governance from their unique disciplinary lenses (e.g., sociology, political science, economics, environmental science), and researchers seeking to answer different research questions. Hence, this body of work remains fractured (Biswas & Tortajada, 2010; Araral & Wang, 2013). Existing frameworks have different purposes, which include but are not limited to understanding the role of institutions in the functionality of water governance systems (Oliveira *et al.*, 2012; Franzen *et al.*, 2015), untangling the interplay of formal (statutory) and informal (customary) components of water governance systems (Wood, 2015; Rola *et al.*, 2016), and explaining the impact of stakeholder participation in planning and decision making on the outcomes of water governance (Carr *et al.*, 2014; Gallego-Ayala & Juizo, 2014). Biswas and Tortajada (2010) argue that independent studies of good water governance would improve our understanding water governance. However, it has been noted that it could be challenging to compare the outcomes of multiple studies due to the utilization of diverse assessment frameworks (Woodhouse & Muller, 2017).

This dissertation addresses this issue by developing a framework for assessing water governance. This developed framework is based on a consolidation and integration of core water governance principles that have been established in the literature over time. Since the existing water governance literature has emerged from multiple disciplines, the framework developed here is multidisciplinary in nature. Following its development, the framework is applied in a case study of Mexico's Lerma-Chapala basin (LChB). Mexico is a country that began its IWRM reform in 1992, resulting in the formation of the Lerma-Chapala Basin

Council (LChBC) as a water governance forum in 1993. This experience is considered appropriate to examine progress in the transition between water governance paradigms, and to identify factors that support or limit the implementation of a viable water governance system.

1.2 A shift in water management paradigms

Before the United Nations Conference on Environment and Development in Rio de Janeiro in 1992, most countries (including Mexico) utilized a sub-sectoral project-based approach to develop, allocate and manage water resources (Garcia, 1998; Savenije & Van der Zaag, 2008). This was characterized by senior government institution(s) utilizing state-centred top-down approaches. This system was also based on a centralized, hierarchical and bureaucratic model, with little or no coordination between sectors and water resource interest groups; thus decisions were made primarily by high ranking officials (GWP, 2000; Falkenmark *et al*., 2004; Savenije & Van der Zaag, 2008; de Loë *et al.,* 2009). Additionally, water management had a predominantly sectoral-technical approach that focused largely on planning, construction and operation of water infrastructure for the purposes of irrigation, energy generation, domestic consumption and industrial uses, while neglecting the management of ecosystems (Radif, 1999; WWAP, 2006; Garcia, 2008).

After the 1992 Rio conference and the publication of 'Agenda 21' (UNDSD, 1993), major international funding, development and aid agencies started promoting IWRM as a solution to water-related problems around the world (Mitchell, 2005; WWAP, 2006; Saravanan *et al.,* 2009; Tortajada, 2014). Consequently, IWRM has been adopted in many countries with varying degrees of success. Examples of these attempts include Mexico's enactment of the National Water Law in 1992 (Mestre, 1997), South Africa's implementation of a National Water Act in 1998 (Aston *et al.,* 2006), and Ghana's establishment of a Water Resources Commission in 1996 (Agyenim & Gupta, 2012), among several others.

Implementing an IWRM process signals an attempt to move away from the technocratic state-oriented top-down approaches that characterized water management before the UN Rio conference, towards more flexible multilevel and multi-stakeholder approaches associated with water management that became prominent after 1992. In this thesis, the terms *pre-Rio* and *post-Rio* are used to depict prevailing water governance

paradigms that existed before and after the 1992 Rio conference respectively. The key characteristics of these contexts are illustrated in Table 1.1. Ongoing water policy reforms represent major changes in many countries. Many jurisdictions are therefore struggling to implement these reforms on the ground (Agyenim & Gupta, 2012; Horlemann & Dombrowsky, 2012; Oliveira *et al*., 2012; Hornidge *et al.,* 2013; Rola *et al.,* 2016).

Table 1.1: Governing approaches for water management before and after Rio

Pre-Rio	Post-Rio
Sectoral approach	Integrated approach
State Control	Inclusive stakeholder engagement
Decisions made by high ranking officials and politicians	Stakeholder participation in decision making
Centralization	Subsidiarity
Top-down approach	Dominance of bottom-up approach
Political boundaries form planning and management units	Basin as planning and management unit
Economic development approach	Sustainable development approach
Focus on supply management	Focus on demand management

The IWRM reforms adopted by many countries are characterized by decentralization policies, multiple stakeholder engagement, polycentric decision making, and the formation of multilevel collaboration networks (Jacobson *et al.,* 2013; Giordano & Shah, 2014; Grigg, 2014; Rola *et al.,* 2016), which are key properties of water governance. Relative to developing countries, developed countries have generally been more successful in the adoption of IWRM, but not without challenges. Rogers and Hall (2003), note that in developed countries the establishment of water governance systems that utilize an integrated approach to water management, followed a long evolutionary process that spanned several decades. For example, "it took the US almost two hundred years to finally build in participation and ecosystem concerns into its water governance" (Rogers & Hall, 2003:30) strategy. By contrast, international financing, development and aid agencies that advocate IWRM expected client countries (largely developing) such as Mexico, Ghana, Mongolia, Philippines to go through this transition over comparatively shorter periods of time (Agyenim & Gupta, 2012; Horlemann & Dombrowsky, 2012; Hornidge *et al.,* 2013; Rola *et al.,* 2016). Thus, little attention was paid to the fact that variations in political and cultural contexts could result in IWRM implementation gaps.

1.3 IWRM and Water Governance

While there exist many definitions of IWRM, the most widely cited definition is that provided by the Global Water Partnership (2000:22) as follows: IWRM is "a process

which promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems". Despite its wide use, this definition has been criticised as being normative, ambiguous and hard to implement (Biswas, 2004, 2008; Giordano & Shah, 2014; Woodhouse & Muller, 2017). IWRM is also described in the literature as a holistic approach that cuts across all sectors and includes social, economic and environmental concerns and interests (Mitchell, 1990; Grigg 2008). An appropriate execution of IWRM should be characterized by inclusive stakeholder participation that considers all water uses in planning and decision making. It should also consider both surface and groundwater, and utilize the basin as a planning and management unit (GWP, 2000). Despite implementing IWRM as a water reform strategy, problems of water availability and quality continue to persist in some jurisdictions among other challenges (WHO & UNICEF, 2014; OECD, 2015; WWAP, 2015).

Tensions and conflicts are inevitable when multiple stakeholders from varying sectors and with widely differing interests depend on the availability, quality and allocation of water resources for their wellbeing and/or success. These conflicting interests among stakeholders over scarce water resources often generate political and organizational problems. Since water is fundamental to the wellbeing of humans and ecosystems, decisions around water allocation and utilization should be approached in an intersectoral (rather than a sectoral) scale to ensure that solutions address diverse needs in a holistic manner.

The World Water Assessment Programme (2006:48) interprets the concept of water governance as follows:

> Governance is about making choices, decisions and tradeoffs. Governance addresses the relationship between organizations and social groups involved in water decision-making, both horizontally, across sectors and between urban and rural areas, and vertically, from local to international levels. Operating principles include downward and upward accountability, transparency, participation, equity, rule of law, ethics and responsiveness. Governance is therefore not limited to 'government' but includes the roles of the private sector and civil society. The character of relationships (and the formal and informal rules and regulations guiding such relationships) and the nature of information flow between different social actors and organizations are both key features of governance.

This interpretation suggests that governance involves dialogue and negotiations among multiple stakeholders (not only government) who are engaged in decision making

concerning water resources (e.g. allocation, policy, development, and rights). It also emphasises the importance of the subsidiarity principle, evident in the need to create vertical and horizontal collaboration and information networks, and the harmonization of formal and informal regulatory and administrative frameworks[1]. Finally, this definition also provides us with seven operating principles of water governance: *accountability, transparency, participation, equity, rule of law, ethics* and *responsiveness*, which the present study regards as core concepts that can be used as criteria to assess water governance, and view what happens in practice. It is in the effort to promote order and mitigate or settle existing and potential problems and conflicts that the link between IWRM and water governance lie.

Water governance pertains to the formal (statutory) and informal (customary) rules, institutions and organizations that guide the actions and interactions of multiple-stakeholders and determines the processes through which water-based decisions are made (Lautze *et al*., 2011; Cook, 2014; Boer *et al.,* 2016; Cookey *et al*., 2016). Water management on the other hand involves day-to-day tasks, including practical, technical and routine functions, such as infrastructural development, operation and monitoring, and the practical implementation of measures and decisions made through a governance processes (Lautze *et al*., 2011; Cook, 2014; Cookey *et al*., 2016). As such, water governance and water management have been defined as independent but interacting concepts (Tortajada, 2010a). Griggs (2011) offers an illustration of this relationship by comparing roles of management and governance in different water sectors (Table 1.2). These examples aid in our understanding of the concepts of water governance and water management within different sectors as used by prominent scholars in the field of water studies (e.g., Tropp, 2007; Tortajada, 2010a; Mitchell, 2013).

[1] Formal and informal systems are those through which authority is exercised (Rogers & Hall, 2003) applying clear mechanisms of control (Aminova & Jagers, 2011). The literature describes formal rules as those being codified and legally adopted (i.e. laws, regulations, legal codes and procedures), and informal rules as those that are not codified and rooted in customs, traditions, practices and/or social conventions (i.e. unwritten socially shared codes of conduct that regulate social life) (WWAP, 2003; Rogers & Hall, 2003; Pahl-Wostl *et al*., 2008). Nonetheless, different elements (i.e., authorities, institutions, regulations, rights, organizations, structures, networks, and processes) and their interactions, are also considered as components of formal and informal systems.

Table 1.2: Management and governance roles for water sectors

Water sector	Management Roles	Governance Roles
Public and industrial supply	Supplies water through utilities and other systems	Regulates access, allocation and quality of water resources while empowering utility services in their role.
Waste water and environmental quality	Provides removal and treatment of wastewater and takes steps to enhance environmental water quality	Ensures access to water is regulated, regulates discharges and water quality, empowers waste water service providers in their role
Stormwater and flooding	Provides stormwater and flood control services	Regulates flooding and nonpoint sources of water, ensures policies and plans exist as precautionary measures
Irrigation and farm drainage	Provides raw water and drainage systems in irrigated and rain-fed zones	Regulates allocation of water for irrigation, allocates farm drainage, empowers irrigators
Instream flow control	Coordinates flow for hydropower, navigation, recreation, fish and wildlife	Establish instream flows, control diversions and discharges rules and principles

Source: after Grigg, 2011.

In general terms, water governance establishes an enabling environment that legitimises appropriate action through regulations, policies and institutional structures (both formal and informal). In this context, water governance should enhance order, transparency, legitimacy, and accountability among water stakeholders, and cater to the appropriate management of water resources.

IWRM policy reforms require changes in the existing interactions (both formal and informal) among politicians, law makers, institutions, regulators and civil society (Rogers& Hall, 2003; Tropp, 2007), among others. To date, these reforms have transformed the way water resources are governed in many jurisdictions that demonstrate a successful transition from more traditional hierarchical state-centred top-down approaches to more inclusive and pluralistic approaches to decision making. Several authors identify this transition among governing systems as a pivotal roadblock to the successful implementation of IWRM (Tropp, 2007; Agyenim & Gupta, 2012; Horlemann & Dombrowsky, 2012; Oliveira *et al*., 2012; Hornidge *et al.*, 2013; Rola *et al.*, 2016). This is a difficult problem to solve, but Rogers and Hall (2003) suggest that the solution may lie in establishing systematic methods to assess progress and to identify where changes are needed, in order to aid in this transition.

This thesis agrees with Jacobson and colleagues (2013), who suggest that an assessment framework could help bridge the implementation gap and provide a systematic

approach for analysing how water governance systems are performing. This is also supported by Horlemann and Dombrowsky (2012:1548), claim that the implementation of an IWRM process “often requires a fundamental realignment of governance structures”. For example, many developing nations have adopted IWRM reforms, and this has required restructuring and creating institutions and organizations (such as river basin councils), to aid in the transition from traditionally authoritarian regimes to more inclusive participatory models for governing water resources. An assessment framework is here seen as a diagnostic tool that will help identify the strengths of governance systems, constraints that hinder the viability of the system, and possible areas of opportunity for improvement. Hence, an assessment framework can help guide water sector reforms towards desired governance and management goals (Halbe *et al*., 2013; Jacobson *et al.*, 2013; Akhmouch & Correia, 2016).

1.4 Approaches to assess of water governance.

In separate reviews of water governance literature Bachelor (2007), Araral and Wang (2013), Woodhouse and Muller (2017), and Pahl-Wostl (2017) found that there is no shortage of approaches for studying water governance due to its interdisciplinary nature, and the absence of a consensual definition of the concept itself. In this context, Woodhouse and Muller (2017) point out that this diversity does not only poses a methodological challenge for the study of water governance, but also makes it difficult for the outcomes of multiple studies to be easily compared. Pahl-Wostl (2017) contends that there is limited knowledge on water governance systems and conditions necessary for successful water governance reforms. Both, Pahl-Wostl (2017) and Woodhouse and Muller (2017) emphasise the need to develop approaches that are context-sensitive. However, Pahl-Wostl (2017) recommends further research on ‘transformative water governance’, and the development of frameworks for analysis as key to enhancing our understanding of water governance.

The present study started out by surveying water governance literature on assessment frameworks. Contemporary water governance literature reveals a wide array of frameworks and methods to assess water governance, which echoes the findings from most studies that have involved a critical review of the literature. It is possible to group the literature based on the main thematic areas of research. These four broad and relevant

clusters of literature include (1) the importance of considering the existing local context (i.e., political, social, cultural, economic, environmental, scale), when developing institutional and/or policy reforms (Hornidge *et al.*, 2013; Wood, 2015; Casiano Flores *et al.*, 2016; Mapedza, *et al.*, 2016); and (2) the value of stakeholder engagement in water policy and in development planning (Bell *et al.*, 2011; Carr *et al.*, 2014; Kuzdas *et al*., 2015; Akhmouch & Clavreul, 2016). For example, in the first case, Casiano Flores, Vikolainen and Bressers (2016) borrowed the "Governance Assessment Tool" developed by the OECD and applied it in the Atoyac sub-basin in the State of Tlaxcala, Mexico. This tool analyses the local context to identify supportive or restrictive conditions for the implementation of water-based policies and/or projects. Their study utilized data from official documents and interviews, which are analysed using a combination of matrix models with descriptive-analytical and semi-normative categories. In this case, results indicated that federal water sanitation policies could not be fully implemented in the sub-basin because the municipality lacked sufficient operational capacities. They concluded that decision makers did not consider local conditions during the policy development phase, resulting in implementation failures. However, they noted that more recent context-sensitive reforms by the state government increased the state's role in sanitation, which resulted in improved implementation of wastewater treatment policy in the sub-basin.

In the case of an example addressing the second thematic area, Dore, Lebel and Molleb (2012) adopted an exploratory problem-solving framework for analysing transboundary water complexes, and applied it in the Mekong basin[2]. The researchers examined connections among water-based stakeholders and institutions, the drivers that influence and motivate actors in their decision making, various tools used for decision making, and the impacts of water allocation decisions. The authors observed that although decision-making processes are not always equitable, there are hopeful signs that the water governance system is becoming more inclusive. They suggest welcoming a diversity of stakeholders with different perspectives as a mechanism for improving water allocation decisions.

While the assortment of frameworks found through the survey of literature contribute to the advancement of knowledge, they add to the complexity of assessing water

[2] The Mekong basin is shared by five countries: China, Vietnam, Myanmar, Thailand, Laos and Cambodia.

governance. The themes of focus are largely acknowledged in the literature as key to better understanding water governance (Rogers, 2002; WWAP, 2003, 2006; Biswas & Tortajada, 2010; Mitchell, 2013; OECD, 2015; Akhmouch & Correia, 2016), and therefore, their results provide valuable information that helps in our understanding of water governance. However, the broad range of frameworks found in the literature makes it difficult to compare results among case studies, and hence, it also constrains the advancement of our knowledge of water governance. This wide array of frameworks to assess different facets of water governance justify the need for a refined and holistic framework which adequately captures multiple stakeholder perspectives, legal and administrative frameworks, existing policies and the trajectory of water governance systems.

1.5 Conceptual framework

Building on existing water governance literature, the current dissertation develops a framework for assessing water governance by refining, consolidating and clearly defining a set of assessment principles[3] (Rogers, 2000; Rogers & Hall, 2003; WWAP, 2003, 2006; Ashton *et al.*, 2005; Ashton *et al.*, 2006; Batchelor, 2007). A framework is here interpreted as a structure that keeps a research project focused by aiding researchers analyse and compare the contents of different data sources to help address their research question (Green, 2014; Imenda, 2014). In the case of the current study, the research question pertains to the efficacy of water governance, while the data that are analysed and compared include policy documents and interviews with the various stakeholders. In geographical terms, such a framework makes it possible to also understand how issues of water governance evolve over space and time. The framework developed in the current study attempts to simplify the analysis of water governance by refining and categorizing existing water governance principles in the literature into fewer coherent groups. The proposed framework is aimed at helping assess the effectiveness of water governance systems by identifying accomplishments and constraints in the implementation of water governance. This framework could also help stakeholders in the planning process by revealing existing water governance deficiencies and making it possible to compare conditions in different socio-political contexts.

[3] Principle is here understood as a fundamental declaration of values, in relation to a specific issue, which functions as a guide that explains how something works (after Ashton *et al.*, 2006).

Peter Rogers (2002) made the first known attempt at offering a set of water governance principles with their respective operational definitions. To date, the most commonly cited water governance principles are those offered by Peter Rogers and Alan Hall (2003) who identified 12 principles that they believe should characterize the structure of effective or viable water governance systems. By doing so, they also "create the important basis for assessing the state of water governance in a given location, and it is through these assessments that opportunities for improvement can be identified" (Lauttze *et al.*, 2011:3). The proposed principles suggest that water governance systems should be (1) open, (2) transparent, (3) inclusive, (4) communicative; (5) coherent, (6) integrative, (7) equitable, (8) ethical, (9) accountable, (10) efficient, (11) responsive, and (12) sustainable. These principles are widely recognized as qualities of a viable water governance system, and remain largely consistent within the broader literature (Lautze *et al.*, 2011). In addition to these principles, the current study draws on other cluster of water governance literature to create a refined set of principles as criteria to assess water governance in the Lerma-Chapala basin.

Methodologically this thesis utilizes content analysis of various official water policy documents and interviews with key informants in the LChB. This research method was chosen for its ability to effectively reduce large amounts of data into coherent themes. Content analysis also made it possible to superimpose the framework on different clusters of data (i.e., policy documents and interviews) and compare them. In this study, eighteen documents spanning over two thousand pages and 51 interviews that cover 84 hours and 48 minutes were analyzed. Because of the broad nature of water governance themes, content analysis is a preferred methodology for researchers working in this context (for examples see Drieschova *et al*., 2008; Pahl-Wostl *et al*., 2008; Atuyambe *et al*., 2011; Farrelly & Brown, 2011; Lukasiewicz *et al*., 2013; Gillet *et al*., 2014; Vedachalam *et al*., 2016). By analysing policy documents and stakeholder perspectives in the context of the proposed framework, the current study also analysed links between theory (i.e., existing policies and plans) and practice (i.e., stakeholders' experience of water governance on the ground). By going back to the basic principles of water governance to develop an all-encompassing framework that captures multiple aspect of water governance this thesis attempts to find common ground, consolidate concepts, strengthen the debate on water

governance, and allow for the comparison of results between case studies. The application of the developed framework to a case study in Mexico also tests the effectiveness of the developed framework.

1.6 Area of study

The Lerma-Chapala basin (LChB) in central Mexico (Figure 1.1) provides an opportunity to apply the proposed water governance assessment framework and further our understanding of the practice of water governance. The LChB experiences common socio-political water management problems that remain prevalent in developing countries seeking to adopt IWRM and improve their water governance strategies. These challenges include a high and continually growing population, rapidly expanding urbanization and industrialization processes, and water demand by the agricultural sector, among other issues (WMO & CONAGUA, 2011). Decades of development in the basin have also created severe water problems, such as high pollution levels and anthropogenically induced water scarcity that have resulted from surface water being over-committed and aquifers over-exploited (WMO & CONAGUA, 2011).

Figure 1.1: Geographic location of the Lerma-Chapala basin

Existing literature identifies the LChB as having one of the richest water governance experiences in Mexico and the broader Latin America (Dourojeanni & Jouravlev, 2001; Mestre, 2001; Parrado Diez, 2004; Sanchez Mesa, 2006; WMO & CONAGUA, 2011). For example, the Lerma-Chapala Basin Council (LChBC) which was created in 1993 was the first water governance forum in Latin America. The literature also acknowledges that

Mexico adopted an IWRM approach to solve its water management problems with the enactment of its National Water Law in 1992 (González-Villarreal & Garduño, 1994; Dourojeanni, 2001; Mestre, 2001). Nonetheless, a viable water governance system has not been achieved in the LChB, as progress in water user participation and the decentralization of functions has been very slow (Torregosa, 2004; Webster *et al*., 2009a).

The LChB is also characterized by a high population density, a high urban population concentration and rapid economic development that relies on water resources. These key characteristics have placed the basin at the core of Mexico's social, political and economic life. Despite covering a small geographical portion of the Mexican territory (i.e., 2.4% of the total landmass), the basin supplies drinking water to 16% of Mexico's population, including 2 million from Mexico City and another 2 million from Guadalajara (Cotler Avalos *et al.,* 2006) through interbasin water transfers. Furthermore, as much as 17% of all industry in Mexico is located within the confines of the basin (Jaime Jáquez, 2004), contributing as much as 35% of Mexico's industrial GNP (Mestre, 1997; Castelán, 2001). The LChB houses approximately 13% of all irrigated lands in Mexico, which are of great worth to the country's agricultural export earnings. Overall the basin's tertiary sector supports a fifth of all national economic activities (Wester *et al*., 2000; Mestre, 2001). The dominant uses of water in the LChB are for agriculture, domestic consumption (i.e., drinking water) and industry (Figure 1.2.a). As illustrated in Figure 1.2.b, most of the water that is put to these uses are derived from groundwater sources. Decades of development and growth in the basin have resulted in surface water been over-allocated and groundwater sources which have generally been over-exploited (Mestre, 2001; Sandoval, 2004; Wester *et al.,* 2009c; WMO & CONAGUA, 2011).

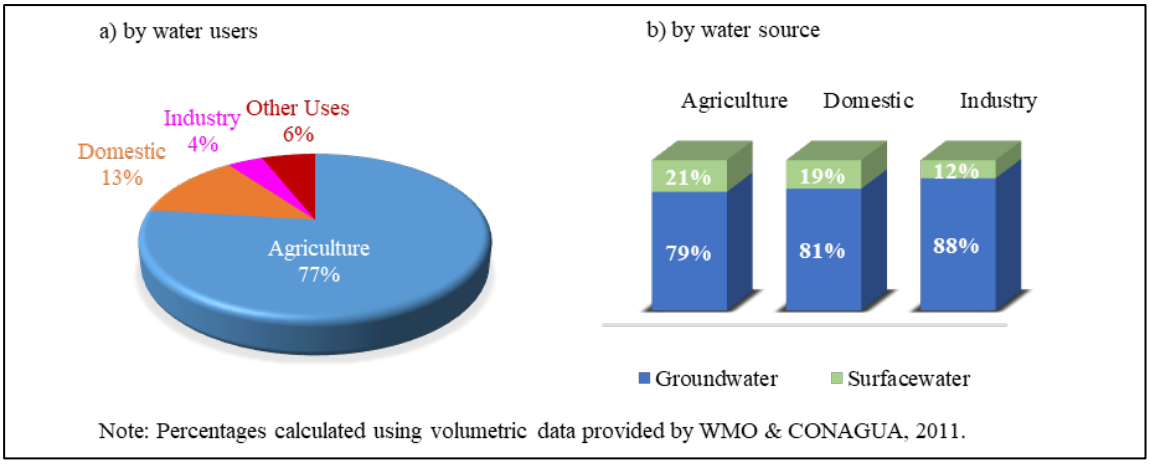

Figure 1.2: Water use in the Lerma-Chapala basin

The contested nature of water within the LChB has resulted in conflicts among state governments, water uses, and water-based stakeholders. The Lerma-Chapala Basin Council (LChBC) was created to implement the water allocation policy, improve water quality and water use efficiency, and conserve the resources and ecosystems of the basin (Mestre *et al.*, 1994; Mestre, 1997; Wester *et al.*, 2000; Castelán, 2001). However, official documents are not specific and only mention that these goals were to be achieved through the creation of 'specialized' workgroups, through consensus building mechanisms, and through a participatory approach. The World Meteorological Organization and Mexico's National Water Commission (WMO & CONAGUA, 2011) report that water pollution and scarcity problems persist in the basin, which raises questions about the ability of the LChBC to achieving desired water governance goals and implement an effective IWRM process.

Conflicts within the basin can be grouped in two different categories: direct resource use conflicts and institutional conflicts. The most relevant direct resource based conflict in the basin is between the states of Guanajuato and Jalisco (up-down river) concerning the availability and allocation of surface water from the Solis Dam. This conflict began in the 1950s and consistently resurges during prolonged periods of drought, the most recent one being between 1999 and 2003. This conflict between the agriculture-based water users in Guanajuato, environmental citizen groups in Jalisco, and Guadalajara's water utility services who use water from Lake Chapala, further demonstrates the persistence of problems in the basin. This also illustrate the need for negotiation and dialogue around issues of water allocation, monitoring and governance. The LChBC is the forum where the negotiations pertaining surface water allocation and the signing of the agreement/treaty for

the allocation of surface water by stakeholders took place. This mutually agreed document was reached through a water governance process, where water users and government representatives from all five states in the basin negotiated for two years before reaching an agreement. This agreement seeks to bring legitimacy, transparency, rules, and clarity to the yearly allocation of surface waters; thus, mitigating the conflict for surface water allocation in the basin.

Regarding institutional conflicts, the most evident challenge exists between the federal government and the government of the state of Guanajuato. One of the most serious problems in the LChB is the overexploitation of groundwater. To address this problem, the government of Guanajuato organized water users into Technical Water Councils (COTAS), which are subsidiary organizations of the LChBC, without the involvement of the National Water Commission (NWC). Consequently, the NWC, which is Mexico's sole water authority, did not recognize these councils and has not delegated authority or responsibilities to manage groundwater by COTAS in Guanajuato (Wester *et al.,* 2009a). This conflict illustrates the need for stakeholder participation, capacity strengthening, agreements for groundwater allocation, and the application of the subsidiarity principle. Details of major conflicts surrounding water governance, management and allocation in the LChB will be discussed further in Chapter 3.

1.7 Problem statement

The current study recognizes the importance of assessment frameworks for monitoring the evolution of water governance over time (e.g., *pre-Rio* and *post-Rio* as demonstrated in Table 1.1). The literature recognizes that the shift from one water management paradigm to the next represents a change in *status quo* in many countries, especially developing nations (Peña & Solanes, 2003; Aston *et al.*, 2006; Sajor & Minh Thu, 2009; Agyenim & Gupta, 2012; Halbe *et al*., 2013; Hornidge *et al*., 2013). Such shifts often results in complex problems that cut across social, political, cultural, and local contexts, consequently influencing the viability of governance systems and their capacity to support or restrict the implementation of IWRM systems (Rogers, 2002; WWAP, 2003, 2006; Rogers & Hall, 2003; Jacobson *et al.,* 2013; Mapedza, *et al.,* 2016). The problem statement of this thesis is as follows: To tease out and understand constraints and

opportunities that emerge from attempts to implement a viable water governance system and an IWRM process through the application of a newly developed framework.

1.8 Research aim and objectives

The current thesis attempts to develop a holistic water governance assessment framework by refining existing principles of water governance contained in the research literature. This could enhance our understanding of water governance by highlighting its core aspects.

The three major objectives of the study are:

- to develop a water governance assessment framework by refining normative attributes that best conceptualize water governance in the existing research literature;
- apply the developed water governance assessment framework to official water policy documents with the aim of understanding *pre-*/*post-Rio* water governance transitions in Mexico; and
- apply the developed water governance assessment framework to stakeholder interviews to understand the state of water governance in the Lerma-Chapala basin, and how these conditions relate to policy and the overall creation of a viable IWRM process.

1.9 Overview of content of thesis

This thesis is divided into seven chapters. This first chapter introduces the study by outlining its aims and objectives. It briefly introduces the conceptual framework and the nature of conflicts in the study area. The second chapter presents the conceptual framework for water governance, outlines its operating principles, and provides working definitions for each of the principles to be used as assessment criteria. The third chapter provides background information on the case study and outlines details of the main conflicts present in the LChB. The fourth chapter discusses the research methods and analytical approaches that were utilized for the study. Chapter five presents the study results, while Chapter six examines the achievements and constraints to water governance in the Lerma-Chapala basin. The thesis concludes with Chapter seven, which discusses policy recommendations and future research opportunities that emerge from this dissertation.

Chapter Two

2 Literature Review

This chapter reviews the existing water governance literature that was drawn on to develop the water governance assessment framework. A total of five water governance principles were developed after reviewing the literature and consolidating existing principles. The chapter also clarifies key concepts such as water governance that are central to the study.

2.1 What is water governance?

While there has been long standing implicit research on water governance, explicit research on the notion is still relatively new (Tropp, 2007; Biswas & Tortajada, 2010; Mitchell, 2013; Pahl-Wostl, 2017; Woodhouse & Muller, 2017). 'Governance' is a concept that was prominently discussed in the social and environmental sciences during the1980s and 1990s. Traditionally, the concept of governance, was strictly defined as the act of 'governing', as is practiced by government and public administration officials (Turner & Hulme, 1997; Stoker, 1998; Johnston *et al*., 2000; Marinetto, 2003; Van Kersbergen & Van Waarden, 2004; Tropp, 2007; de Loë *et al*., 2009). Overtime, the concept of 'governance' has evolved to include the ways in which power, authority, and decision making are arranged within a multilevel and multi-stakeholder (i.e., civil society, private sector and various levels of government) collaborative structure, where government maintains some steering capacity[4] (Jessop, 1997; Rhodes, 1997; Stoker, 1998; Fukuda-Parr & Ponzio, 2002; Marinetto, 2003). Thus, the concept now transcends previous notions that portrayed it as characterized by top-down structures and practices. This is noteworthy in the area of water governance since the implementation governance in the water sector requires major changes in policy, institutional structures and management, which in many jurisdictions represents an important change to the prevailing *status quo* (Hornidge *et al.*, 2013; Mapedza *et al.*, 2016; Rola *et al.*, 2016). Hence, attempts to implement water governance systems often encounter resistance from powerful traditional forces that favour a centralized, hierarchical, state-oriented, top-down approach.

[4] *Steering capacity* refers to the idea of being able to "influence" or "steer" decisions in a particular direction, as opposed to a control-command structure where decisions are made unilaterally by top level authority.

Good governance in the water sector was first identified as a means to achieve water security at the Second World Water Forum in The Hague in 2000 (Rogers & Hall, 2003). As part of the forum, the Global Water Partnership identified water governance as the first of four priority areas for action, stating that "the water crisis is mainly a crisis of governance" (GWP, 2000a:16). To date no strong census exists on a single definition for water governance (Moench *et al.*, 2003; WWAP, 2003, 2006; Biswas & Tortajada, 2010, 2010a; Lautze *et al*., 2011; Araral & Wang, 2013; Varis *et al*., 2014; Pahl-Wostl, 2017; Woodhouse & Muller, 2017). There are therefore many interpretations and definitions of water governance. For example, Rogers and Hall (2003) see water governance as a range of political, social and administrative 'systems' meant to develop and manage water resources and services. Further, the World Water Assessment Program (2003) considers water governance as including all social, political and economic 'organizations and institutions', and their 'relationships' to water resources development and management. Finally, the United Nations Development Program (2004) views water governance as political, social and economic 'processes and institutions' through which multiple stakeholders 'make decisions' about how best to use, develop and manage water resources.

As a consequence of water governance having multiple definitions and interpretations, there are no standard approaches for assessing water governance. Water governance research also remains largely fractured (Biswas & Tortajada, 2010; Araral & Wang, 2013), hence the need for an assessment framework that consolidates multiple approaches to understand water governance. A search for common ground is desirable because a unifying assessment framework could make it possible to compare and understand the evolution of water governance structures over time and between different jurisdictions.

Since the 1990s, IWRM reforms have been changing the way water resources are governed in many countries. However, the extent to which water sectors have transitioned form traditional state-centred top-down approaches (i.e., *pre-Rio* approaches), to a multilevel, multi-stakeholder collaborative approaches implied in the concept of water governance (i.e., *post-Rio* approaches) remains unclear (Chan, 2009; Sajor & Minh Thu, 2009; Horlemann & Dombrowsky, 2012; Dell'Angelo *et al.,* 2016). Rogers (2002) explains that a framework to improve water governance systems is needed because experiences from

many countries have shown that the actual performance of 'textbook' laws, institutions and regulations in the water sector have produced poor outcomes, suggesting that there are no 'reasonable' functioning political system to implement them. Within the literature, there is an abundance of examples that indeed reveal the poor implementation of water governance related reforms (Wester *et al.*, 2009a; Agyenim & Gupta, 2012; Oliveira *et al.*, 2012; Hornidge *et al.*, 2013; Casiano Flores *et al.*, 2016; Mapedza *et al.*, 2016; Rola *et al.*, 2016). Nonetheless, the literature also shows that within some socio-political contexts, some levels of success have been achieved (Lemos & Farias de Oliveira, 2004; Biswas & Tortajada, 2010a; da Costa Silva, 2011; Lennox *et al.*, 2011; Dore *et al.*, 2012; Gallego-Ayala & Juizo, 2014; Mitchel *et al.*, 2014). As has been noted by Norman *et al* (2013) and others (e.g., Grwcksch, 2015; Kuzdas *et al.*, 2015; de Boer *et al.*, 2016) the wide range of approaches to assessing water governance makes it difficult to compare these case studies. To date, there have been several calls for a unifying holistic framework for assessing and monitoring the progress of water governance (Rogers & Hall, 2003; WWAP, 2003, 2006; Tropp, 2007; Biswas & Tortajada, 2010; Jacobson *et al.*, 2013; OECD, 2015; Pahl-Wostl, 2017). These examples further justify the need to develop a water governance assessment framework that builds on the fragmented and largely dispersed literature.

Rogers (2002) warns that there is no blue print or single model for effective water governance, because each case is dependent upon context. He also contends that the practice of water governance could become clearer through *post-hoc* examinations, and offers twelve principles of what should characterize an effective water governance system. These principles provide an evaluative lens against which to assess the characteristics of different water governance systems, and could help to identify challenges and opportunities to guide reforms aimed towards shaping an adequate or valid water governance system. In this sense, the present study agrees with Woodhouse and Muller (2017), who suggest that due to local complexity and diversity, practice can only be guided by general principles of water governance to address water issues and achieve social, economic and ecological goals.

The water governance literature offers a number of explicit principles that have been used in diverse combinations. This thesis postulates that these principles provide common ground for debate and consolidating ideas. Though dispersed, they represent an important

step towards a unified concept of water governance. Through a literature survey, the current study identified seventeen different water governance principles, for which operational definitions are provided in the literature. These commonly cited water governance principles are: *participative, inclusive, democratic, coherent, efficient, responsive, effective, equitable, ethical, accountable, integrity, rule of law, open, transparent, communicative, integrative,* and *sustainable* (Rogers, 2002; Rogers & Hall, 2003; WWAP, 2003, 2006; Ashton *et al.*, 2005; Ashton *et al.*, 2006; Barreira, 2006; Batchelor, 2007; Lautze *et al.*, 2011; FAO, 2013; Mitchell, 2013). A critical look at these principles and the context of their use in the literature clearly revels that differently labeled principles sometimes overlap in meaning. The current study therefore categorizes them into fewer coherent groups based on similar meanings and key unifying elements. Following the categorization, the new framework is tested by applying it to a case study.

Before moving any further into our framework, it is necessary to briefly present an in-depth summary of literature that addresses different water governance assessment frameworks and methods.

2.2 Water governance: issues and frameworks

The present study agrees with Woodhouse and Muller (2017) and Pahl-Wostl (2017) who both contend that the wide range of perspectives on water governance pose a methodological challenge for researchers seeking to understand the concept of how it evolves in specific contexts. A comprehensive review of literature that has sought to assess water governance between 2009 and 2016 reveals that there are almost as many assessment frameworks or approaches as the published articles. While these diverse frameworks are valuable in themselves, it is evident that a unifying framework could be more beneficial by making studies comparable and giving researchers the opportunity to track the spatio-temporal evolution of water governance. The only common ground in these clusters of literature is the frequent use of the basin as the spatial unit for assessing water governance.

Despite the wide range of frameworks and approaches to assess water governance, the present study grouped the assessment frameworks identified into four overarching thematic areas of research associated with water governance. These include (a) the importance of considering the existing local context, when developing institutional and/or policy reforms, (b) prevailing governing systems and their role in the implementation of

water governance reforms, (c) stakeholder engagement in water policy and in development planning, and (d) the capacity of water governance systems to adapt and address changing or evolving challenges and their adverse effects.

It is important to note that these groups are not mutually exclusive. As Aston and colleagues (2005) have explained, various components of water governance are interrelated and interdependent. Consequently, studies that focus on one thematic area of research tend to touch on attributes of water governance that are associated with a different thematic area. An example can be seen in the work of Dell'Angelo *et al* (2016) in their study of the capacity of water governance systems to adapt and address changing or evolving challenges within the Ewaso Ng'iro River basin of Mount Kenya. Despite their primary focus on the adaptive capacity of water governance systems, their study veers into other topics associated with stakeholder engagement. Such complexities explain the fact that water governance themes overlap. Hence, the four thematic groups developed in the current study to capture the key issues addressed in the assessment of water governance within the literature are not mutually exclusive.

The first thematic group pertains to the need for decision makers to consider local context (i.e., political, social, cultural, economic, environmental) when developing institutional, legal and or policy reforms. In the end, it could be the prevailing local context that determines the outcomes of implemented policies, plans and programs (Jacobson *et al*., 2013). When assessing water governance in local context, the relationship between formal (statutory) and informal (customary) systems has characterized the work of several researchers (Funder *et al*., 2010; Hornidge *et al.*, 2013; Wood, 2015; Mapedza, *et al.*, 2016; Rola *et al.*, 2016). In their work that assessed water governance reforms in the Philippines using a 'stage-based approach to institutional reforms', Rola and colleagues (2016) noted that formal institutional reforms have often met opposition from local traditional (informal) systems. Hence, the core goals for most structural changes were unsuccessful. A study by Hornidge, Oberkircher, and Kudryavtseva (2013) that drew from social constructivism and boundary work came to similar conclusions upon assessing the implementation of irrigation reforms in Uzbekistan. They concluded that local (informal) water management practices remained dominant, in spite of formal institutional reforms (i.e., local water governance forums are not working). These examples relate to the water governance principles of *rule*

of law, transparency and *accountability* mentioned in the literature, since they illustrate the need for a strong and clear regulatory system which amalgamates formal and informal systems and highlights the importance of local voices in policy implementation.

Another justification for the need to consider local context in the development of institutional, legal and or policy reforms, lies in the issue of scale. Dewulf, Mancero, Cardenas and Sucozhanay (2011) state that paying attention to scale is particularly important for outlining problems and defining relevant actors that should be factored into the conflict resolution process. The fact that water resources are not spatially confined to political boundaries also makes the issue of scale relevant. For example, the pollution of water in a specific jurisdiction could impact the quality of water that flows into another jurisdiction connected to the same water body. Gillet, McKay and Keremane (2014) addressed the issue of scale when they examined water disputes among water uses (i.e., irrigated agriculture and commercial forestry) triggered by a water allocation reform in the Lower Limestone Coast of south Australia. They found that conflicts could not be solved at the local level; hence, the judicial process had to be moved up to the state level in order to resolve the situation. This demonstrates that scale is inherently political, and should also be factored into the level at which issues are resolved. The scale level is directly associated with the concept of subsidiarity with regards of making decisions and taking actions at the most appropriate level, which is related to the water governance principles of *coherence, responsiveness, efficiency,* and *effectiveness*.

A second thematic area of research assesses issues related to the prevailing governing systems and their implication in the implementation of water governance reforms. International financing, development and aid agencies have pushed client countries to pass IWRM reforms, which in many cases represent a change in *status quo* (Peña & Solanes, 2003; Aston *et al.*, 2006; Ballweber, 2006; Sajor & Minh Thu, 2009; Agyenim & Gupta, 2012). As a result, the assessment literature has paid attention to the role of various actors and institutions in the implementation of water governance systems. De Boer, Kruijf, Özerol and Bressers (2016) in the examination of the relationship between the existing water governance system and collaborative actions and interactions among stakeholders build upon a collaboration framework with eight distinct and previously established classes of governance systems, which they apply to five case studies. They

conclude that the outcomes of a water governance system can be determined by the supportive and/or restrictive nature of stakeholder actions, especially those in higher levels of government.

This finding is supported by several other studies (e.g., Wester *et al.*, 2009a; Farrelly & Brown, 2011; Horlemann & Dombrowsky, 2012; Oliveira *et al*., 2012; Franzen *et al*., 2015). Oliveira, Heller, Nacimento and Lobina (2012) who applied the path dependency theory to the municipality of Belo Horizonte, Brazil, concluded that policy reforms towards an integrated and participative water management model have not been sufficient to break down old practices. Similarly, Franzen, Hammer, and Balfors (2015) who analyse how institutional legacies affect water policy reforms in southern Sweden concluded that the governance approaches utilized by different river basin organizations around water user participation vary in part because of 'institutional memory'. They also conclude that the legacy of memory within institutional arrangements can facilitate or impede the development of cooperative networks, stakeholder participation and consequently, goal achievement. Finally, Horlemann & Dombrowsky (2012) apply a theory-based approach drawing from Young's (2002) fit-interplay concept to analyse progress and problems in the implementation of IWRM in Mongolia. Their results show that horizontal and vertical coordination is challenging in Mongolia because the roles and responsibilities of stakeholders are not clearly defined in law, and because the capacities of newly created institutions and organizations need to be strengthened. They also conclude that rapid institutional change created friction between new and old institutional structures thus creating a gap in the implementation of IWRM.

This thematic area of research is associated with several water governance principles. First, it addresses the need to clearly establish roles and responsibilities of actors and institutions (i.e., *rule of law*), in order to hold institutions and individuals accountable for their actions (i.e., *accountability*), but also to facilitate collaborative stakeholder action (i.e., *coherence, participation*). This group of frameworks are also associated with the idea that water management functions best when and resource-based decisions are made at the lowest appropriate level of social aggregation (*responsive, efficient, effective*), which implies vertical and horizontal information and collaboration networks (*open, transparent, communicative, integrative*).

A third thematic area deals with stakeholder engagement in water policy and development planning. Public participation has been part of the sustainable development debate since the late 20th century. The Rio Conference on Environment and Development declared that environmental issues have better results with the participation of all citizens, (see Principle 10, Rio Declaration 1992). Today, stakeholder participation is being promoted globally by international development and financial institutions when promoting sustainable development, IWRM, and water governance. With regards to water governance in particular, it is considered that the effective implementation of stakeholder participation in a decision-making process could bring transparency and accountability to the process, and led to decisions that are grounded in consensus and legitimacy. Such decisions tend to be more achievable (Rogers, 2002; Rogers & Hall, 2003; WWAP, 2003, 2006).

This literature provides evidence that stakeholder participation can enhance the implementation and outcomes of water policies and programs (Bell *et al.*, 2011; Dore *et al.*, 2012; Norman *et al.*, 2013; Carr *et al.*, 2014; Gallego-Ayala & Juizo, 2014; Kuzdas *et al.*, 2015; Akhmouch & Clavreul, 2016). Utilizing an "Analytical Hierarchical Process", Gallego-Ayala and Juizo (2014) in an assessment of stakeholder involvement in the context of Mozambique's Incomati River Basin acknowledge that stakeholder participation and involvement in the planning and decision-making process is central to successful water governance. Norman and colleagues (2013) developed the Water Security Status Indicators assessment method, which utilizes participatory methods that allow communities to assess their water security status. After applying the assessment, they concluded that active stakeholder engagement is an essential component of integrated planning and management, without which water governance goals cannot be achieved. Finally, Akhmouch and Clavreul (2016) conducted an OECD study on "Stakeholder Engagement for Inclusive Water Governance" (OECD, 2015a), and sought to assess stakeholder engagement in water-related decision-making, and the extent to which this leads to greater effectiveness, efficiency and inclusiveness. Their findings support recommendations for balanced stakeholder representation and open and regular communications among stakeholders to help steer successful water governance systems.

This thematic area of research is in agreement with several water governance principles. First, it establishes the idea that decision making in a water governance process

should involve the participation of a wide range of stakeholders (*inclusive, democratic, equitable, participation*). Second, it promotes the notion that relevant clusters of information should be made available to promote effective dialogue, negotiations and decision making (*open, communicative, transparency, accountability*).

Within the water governance research community, debates around the extent to which participation should occur and what role it should play continue to persist. The extent to which stakeholders should get involved, the nature of the involvement, the extent of power sharing, and the planning stage at which stakeholder participation should be considered largely depends on the socio-political context and the supportiveness or restrictiveness of prevailing governance systems (OECD, 2015a). It is also important to bear in mind that cultural, political, social, economic, educational and other local characteristics change over space and time, potentially impacting the level and type of stakeholder involvement at different times. This is illustrated in the work of Da Costa Silva (2011) who developed and applied a framework for understanding environmental justice in the context of 'community-based watershed management' in four Latin American countries. She concludes that the community-based watershed management projects have been able to mitigate environmental vulnerability and risk to access water resources. However, her results also reveal constraints that limit social participation, including the lack of clarity in stakeholder roles and the lack of capacities of the institutions responsible for implementing participatory tools. Interestingly, despite governance systems that promoted decentralization and participation, within the study communities, her study did not find any evidence of communities being empowered.

Akhmouch and Clavreul (2016) are the only researchers found in this review of literature who provided an explicit typology of levels of stakeholder participation for their research. To determine the levels of stakeholder involvement, this dissertation uses Arnstein's (1969) levels of participation, which has been commonly utilized in the literature. These levels, representing the degree to which power is redistributed from a top-down to a bottom-up approach, are illustrated as rungs on a "ladder of citizen participation" arranged in a descending order of degree of participation (i.e., from optimum to minimal participation) (Table 2.1).

Table 2.1: Arnstein's Eight Rungs on a Ladder of Citizen Participation

Rungs on a Ladder of Citizen Participation	Nature of the Involvement	Degree of Involvement (Power Sharing)
8. Citizen control	Citizens have full charge of policy and managerial aspects	Degrees of citizen Power
7. Delegated power	Citizens are given management power for selected or all parts of a particular plan or program	
6. Partnership	Trade-offs are negotiated, and there are no unilateral changes	
5. Placation	Advice is received from citizens but not necessarily acted upon	Degrees of tokenism
4. Consultation	Citizens are heard but not necessarily considered	
3. Informing	Citizens' rights, responsibilities and options are identified	
2. Therapy	Power holders educate or cure citizens	Non-participation
1. Manipulation	Rubberstamp advisory committees	

Source: Arnstein, 1969.

With regards to the type of participation, the literature suggests that this should be selected according to individual and institutional capacities, context, and the goals and objectives established (Mitchell, 2002; Gomez & Nakatt, 2002). These forms of stakeholder participation may be applied in various combinations at different stages of implementation.

The fourth thematic area of research seeks to understand water governance systems and their capacity to adapt and address ever changing challenges. These studies focus on the adaptive capacity of water governance systems to respond to the uncertainties of climate change and increasing population. These changing or evolving factors usually involve many different sectors and require an integrated approach to be adequately addressed. Consequently, the frameworks in this group assess aspects related to collaboration, information sharing and the ability of stakeholders to respond to adverse effects such as drought and flooding (Engle & Lemos, 2010; Hurlbert & Diaz, 2013; Grecksch, 2015; Van Leeuwen & Sjerps, 2015, 2016; Dell'Angelo *et al.*, 2016). For example, Grecksch (2015), modified the Adaptive Capacity Wheel by adding two dimensions (i.e., adaptation motivation and adaptation belief), and assess the adaptive capacity of water governance in the Keiskamma River Catchment, South Africa, and uses the framework as a communication tool with stakeholders to identify strengths and weaknesses in the implementation of adaptation measures. He concludes that to overcome the implementation

gap it is necessary to ensure better coordination across and within governmental levels, to raise awareness, to strengthen institutional capacities and skills of decision makers and the public, and to increase the political will in order to overcome adaptation barriers. He recommends developing councillor awareness program in order to have better informed participation.

In another example, Dell'Angelo, McCord, Gower, Carpenter, Caylor, and Evans (2016), applied a multimethod approach and used Ostrom's eight 'design principles' of natural-resource management as a diagnostic framework for five communities on the Ewaso Ng'iro River basin on Mount Kenya. They conclude that the current water governance system on the basin has produced positive outcomes, increased stakeholder's dialogue and participation, and decreased conflicts. However, there are concerns that the system is not adaptable to changing conditions related to population growth and climate change. This study illustrates the importance of institutional systems that stakeholders to collaborate and share information around issues of adaptation to population increase and environmental change. This last thematic area of research relates to a number of the water governance principles. It addresses the participation of a wide range of stakeholders (i.e., *inclusive, participation, equitable*), the importance of defining stakeholder roles to facilitate the collaboration (i.e., *coherence, rule of law*), the importance of making relevant information available to stakeholders to aid in decision making (i.e., *communicative, transparent, open*), the necessity of considering local context (i.e., *coherence, responsive, ethical*), and the importance of decision making that has implications for the long-term management of water resources (i.e., *integration, sustainable*).

This cluster of literature discussed above shows that a variety of approaches have been applied to assess different aspects of water governance. It also reveals that there are many methods that have been applied, but there is no common ground on methods for evaluation, which further explain the complexity of assessing water governance. For example, some researchers use hypothesis testing (de Boer *et al.*, 2016), others identify key themes (Wood, 2015), some measure percentages (Funder *et al*., 2010) or frequencies (Baumgartne & Pahl-Wostl, 2013), others look for trends (Carr *et al*., 2014) or patterns (Cook, 2014), and some used a comparative approach (da Costa Silva, 2011; Oliveira *et*

al., 2012; Franzen *et al.*, 2015). For the most part, researchers have studied formal and informal aspects of water governance and relied on primary and secondary sources of information (i.e. interviews and surveys, or articles, media, texts). The literature review also reveals that most authors tend to use a descriptive approach (Chan, 2009; Wester *et al.*, 2009; Bakker & Cook, 2011; da Costa Silva, 2011; Horlemann & Dombrowsky, 2012; Hornidge *et al.*, 2013; Hurlbert & Diaz, 2013; Cook, 2014; Mapedza *et al.*, 2016; Rola *et al.*, 2016) to evaluate different characteristics of water governance, while others use a combination of qualitative and quantitative methods (Engle & Lemos, 2010; Bell *et al.*, 2011; Cookey *et al.*, 2016; Akhmouch & Clavreul, 2016; Dell'Angelo *et al.*, 2016). The present study, like others, considers systematization and replicability as fundamental to a good data analysis, especially in studying confect ridden issues. Due to the complex and multifaceted nature of issues that emerge in water governance and the large amount of data that was analysed in the current study (i.e., policy documents and interviews), content analysis was used as a systematic and replicable data analysis tool.

Finally, the survey of literature identified that most frameworks use a normative approach and compare case studies to desired ends and ideas that determine what ought to be done. It also identified a total of eight articles that used specific principles in their assessment. The principles used by Dell'Angelo and colleagues (2016)[5] and those proposed by Akhmouch and Correia (2016)[6] are the ones that at first glance seem more different from those offered by Rogers and Hall (2003). However, their associated concepts are described or defined similarly. The other researchers (Engle & Lemos, 2010; da Costa Silva, 2011; Oliveira *et al*., 2012; Hurlbert & Diaz, 2013; Grecksch, 2015; Van Leeuwen & Sjerps, 2016) use different combinations of three or four principles, with *participation* and *accountability* being the most frequently used, followed by *responsiveness*, *equity* and *capacity*. Most of the principles used in these six studies are included in the group of

[5] Ostrom's eight 'design principles' of natural-resource management: (1) Clear boundaries, (2) congruence with local conditions, (3) collective-choice arrangements, (4) monitoring, (5) graduated sanctions, (6) conflict resolution mechanisms, (7) recognition of the right to organization, and (8) nested governance (Dell'Angelo *et al.*, 2016).

[6] Twelve OECD principles on water governance: (1) Capacity, (2) policy coherence, (3) appropriate scales within basin systems, (4) clear roles & responsibilities, (5) monitoring &evaluation, (6) trade-offs across users, rural & urban areas, & generations, (7) stakeholder engagement, (8) integrity & transparency, (9) innovative governance, (10) regulatory framework, (11) financing, and (12) data& information (OECD, 2015; Akhmouch & Correia, 2016).

seventeen principles for which operational definitions were found in the literature (Rogers, 2002; Rogers & Hall, 2003; WWAP, 2003, 2006; Ashton *et al.*, 2005; Ashton *et al.*, 2006; Batchelor, 2007).

In summary, there are two major considerations necessary for deriving the core components of water governance and developing an assessment framework. These include the multifaceted nature of water governance, and the multiplicity and diversity in approaches found in contemporary literature that assesses the different aspects of water governance. Since the literature covers sufficient grounds on water governance when viewed as a whole, it seems unreasonable to add to the complexity of existing approaches. Hence, the study attempts to refine and consolidate existing frameworks or concepts that have been used to study water governance into fewer and understandable clusters. This can be seen as an attempt to go back to the basic principles of water governance, finding common grounds within the disparate literature and developing a holistic framework.

The framework developed in this study therefore provides opportunities for the comprehensive and systematic analysis of water governance systems to identify where changes are needed and hopefully, help bridge the gap in the implementation of IWRM processes in practice.

2.3 Back to the basics: principles for building a water governance framework

Theoretical challenges that are presented by the complexity of assessing water governance and management have resulted in the proliferation of principles used in the literature to assess different water governance systems. The present study identified seven publications with commonly cited water governance principles. Thus, the principles cited in most of the literature overlap with at least one of these seven clusters of literature. Additionally, these seven publications (Rogers, 2002; Rogers & Hall, 2003; WWAP, 2003, 2006; Aston *et al.*, 2005; Aston *et al.*, 2006; Bachelor, 2007) provide clear operational definitions for each principle. In total, this study identified seventeen different water governance principles with clear definitions in the literature (see Table 2.2). These principles are considered essential for effective water governance (Rogers, 2002; Rogers & Hall, 2003; WWAP, 2003, 2006; Ashton *et al.*, 2005; Ashton *et al.*, 2006; Barreira, 2006; Batchelor, 2007).

Table 2.2: Water governance principles defined by researchers

Principles	Rogers, 2002	Rogers & Hall, 2003*	WWAP, 2003	Ashton *et al.*, 2005	Ashton *et al.*, 2006	WWAP, 2006	Batchelor, 2007 *
1 Participative	X		X	X	X	X	
2 Democratic				X			
3 Equitable	X	X	X			X	X
4 Inclusive		X					X
5 Coherent	X	X	X	X	X	X	X
6 Efficient	X	X					X
7 Responsive		X	X			X	X
8 Effective	X			X	X	X	
9 Ethical	X	X	X			X	X
10 Accountable	X	X	X	X	X	X	X
11 Integrity				X			
12 Rule of law						X	
13 Open	X	X		X	X		X
14 Transparent	X	X	X			X	X
15 Communicative	X	X					X
16 Integrative	X	X	X			X	X
17 Sustainable	X	X					X
Total number of principles	12	12	8	7	5	10	12

* Consolidated principles were segregated to better represent the water governance principles included in each publication.

The existing range of principles in the literature, which sometimes have overlapping meanings, makes the analysis of water governance complicated and difficult to capture coherently. Some researchers have attempted to reduce the number of existing principles into fewer categories to enable more coherent and well-structured analysis. Rogers and Hall (2003) consolidated twelve principles that were proposed by Rogers's (2002) into seven principles. For example, to reduce redundancy, they bundled the principles of *open* and *transparent* into one principle (i.e., *Open and Transparent*) since both principles pertain to good governance being open (i.e., having institutions that work in an open manner) and being transparent (i.e., having structures in place that ensure that ensure policy decisions are transparent so that all policy stakeholders can easily follow the steps taken in the policy formulation). As seen in the above example, overlaps among principles makes it possible to reduce them into fewer coherent and well connected categories. Another example to reduce water governance principles is evident in the work of the World Water Assessment Program (2006). They identified an overlap between *effectiveness* and *efficiency*, and merged them into a single principle (i.e., *Effectiveness and Efficiency*), stating that "processes and institutions should produce results that meet needs while making the best use of resources". This definition captures individual definitions of the Effectiveness and Efficiency principles provided by Rogers (2002).

There are also cases where commonalities among principles are not as clear. For example, Rogers and Hall (2003) bundle *inclusive* and *communicative;* where the former makes reference to wide stakeholder participation that follows "an inclusive approach when developing and implementing policies", and the later identifies the need for governance institutions and systems "to communicate among the actors and stakeholders in very direct ways". Even though broad participation is recognized by the authors as being built on the free flow of information, the overlap among these two principles is not explicit. The bundling of the principles *inclusive* and *communicative* by Rogers and Hall (2003) provides a good example where it is effective to merge two complementary principles that may not directly have a shared meaning.

After examining the seventeen water governance principles offered in the literature, several redundancies and/or overlaps of concepts were identified. Thus, while the authors captured in Table 2.2 utilized different principles to assess water governance systems, there were concepts that were labeled differently and defined similarly. The two publications that provide a more detailed definition for each principle are the ones by Rogers (2002) and Rogers and Hall (2003), and their work appears to influence the operational definitions provided in later publications (see Appendix II). It was also noticed that researchers often used different terminology in reference to the same concepts. For example, *effective* and *responsive* are two principles that were found to be redundant. Rogers (2002) states that a water governance system should be *effective.* He then mentions that "Effectiveness also depends on implementing policies in a proportionate manner and on taking decisions at the most appropriate level" (Rogers, 2002:3). Rogers and Hall (2003) do not include *effective* within their list of principles but include *responsive* instead, and state that "Responsiveness also requires policies to be implemented in a proportionate manner and decisions to be taken at the most appropriate level". '*Participative*' and '*inclusive'* were another set of principles with different labels and similar meanings. In such cases where the definitions provided for diverse principles were very similar the principles were merged under a single umbrella principle.

The reduction and refinement process reduced the number of principles from seventeen to five overarching water governance principles (i.e., *participation, coherence, rule of law, knowledge,* and *integration).* Refined definitions were then developed for each

new principle, based on the consolidation of minor differences in multiple definitions that depicted the same idea in the literature. For example, when Rogers (2002:3) operationalises the principle *open,* he states that stakeholders "should actively communicate about what the institutions and government do and the decisions they take" and "use language that is accessible and understandable for the general public". This characterization overlaps with that of *transparency,* which requires that "policy decisions be transparent so that both insiders and outsiders can easily follow the steps taken in the policy formulation" and with *communicative,* which considers that "governance institutions and systems need to communicate among the actors and stakeholders in very direct ways". Therefore, *open, transparent* and *communicative* principles could be encapsulated within a single principle.

Two steps were taken in the development of the water governance principles proposed in the current study. First, it was necessary to make generalizations that subdivide various features into component parts, after which attention was focused on key unifying elements and similarities. Once the main topics were identified and the groups organized, it was necessary to divide some of the principles offered in the literature into subtopics. This was done in order to include them in the operational definition of a more coherent principle. For example, the principle *equitable,* which is defined by Rogers and Hall (2003:28) as:

> All men and women should have opportunities to improve or maintain their well-being. Equity between and among the various interest groups, stakeholders, and consumer-voters needs to be carefully monitored throughout the process of policy development and implementation. It is essential that the penalties for malfeasance are, and are seen to be, equitably applied.

This definition appeals to the concept of *participation* in the sense that it makes reference to an enabling environment that provides the opportunity for all men and women to participate in decision making to defend their rights to water. Nonetheless, this definition also makes reference to established mechanisms that monitor and guarantee the inclusive participation of all interest groups in policy development and implementation, and encourages penalties for wrong doing, which makes reference to the concept of *rule of law*. Consequently, the principle *equitable* was subdivided into component parts; (1) the idea that all men and women should have the opportunity to voice their concerns and defend their interests in a decision-making process, was included in the principle '*Participation*' proposed in the present study, while (2) the idea that a clear system of oversight and checks

and balances should be established, to monitor compliance with the law, and the idea of allocating penalties was included in the definition of the principle '*Rule of law*' proposed in the present study. Table 2.3 provides details of all five principles that were generated from the aforementioned process.

Table 2.3: Water governance principles

Principles commonly offered in the literature	Refined principles used in the proposed framework
Participative Democratic Equitable Inclusive	Participation
Coherent Efficient Effective Responsive	Coherence
Ethical Integrity Accountable Rule of law	Rule of Law
Open Transparent Communicative	Knowledge
Integrative Sustainable	Integration

This responds to the call of Ashton *et al* (2005) who emphasize the necessity of integrating and including all water governance principles into a coherent cluster for the study and effective implementation of water governance. These principles not only represent the ideal settings of how water governance should function, but also provide a system for establishing and assessing criteria pertaining to the state of water governance and its associated strengths and opportunities in specific geographical locations (Rogers, 2002; Rogers & Hall, 2003; WWAP, 2003, 2006; Ashton *et al.*, 2005; Ashton *et al.*, 2006; Barreira, 2006; Hooper, 2006; Batchelor, 2007; Saravanan, 2009; Lauttze *et al.*, 2011; FAO, 2013; Mitchell, 2013).

Literature points to the importance of considering formal and informal structures in the assessment of water governance systems (Aminova & Jagers, 2011; Farrelly & Brown, 2011; Hornidge *et al.*, 2013; Jacobson, 2013; Mapedza *et al.*, 2016; Rola *et al.*, 2016). In

this regard, Jacobson, Meyer, Oia, Reddy, and Tropp (2013) indicate that formal (statutory) and informal (customary) structures may be compatible or incompatible, and they could effectively manage water resources or could compete with one another. Because water governance operated under various formal and informal structures, the current studies also factors these structures into the study of water governance

2.3.1 Water governance principles

This section presents the five water governance principles[7] proposed in the current thesis. The section is organized according to the five principles. Under each of these principles, various clusters of literature are reviewed to capture the context of their use and multiple meanings associated with them. Following this exercise, each subsection concludes with the conceptualization of the principle as used in this thesis. The five water governance principles proposed in this thesis are discussed and conceptualized as follows:

(a) *Participation:*

In order to be successful, water governance should involve a multilateral and inclusive decision making process that ensures the participation of all stakeholders within the context of a river basin (Rogers, 2002; Moench *et al.,* 2003; Peña & Solanes, 2003; Rogers & Hall, 2003; WWAP, 2003, 2006, 2015; Parrado Diez, 2004; Ashton *et al.,* 2005; Tortajada, 2010a; WGF, 2012). These stakeholders should include all levels of government, the private sector, civil social organizations, and all other public and private service water users. To the best extent possible, these stakeholders should be engaged the policy- and decision-making process from conception, to implementation, and evaluation (Rogers, 2002; Rogers & Hall, 2003; WWAP, 2003, 2006, 2015; Ashton *et al.,* 2005; Tortajada, 2010a). Power sharing and legitimate stakeholder representation are key elements that should characterize a successful water governance system (WWAP, 2003, 2006; Falkenmark *et al.,* 2004; Saravanan *et al.,* 2009).

A viable water governance system should also provide opportunities for the participation of all men and women, regardless of their social, ethnical or religious conditions. Broad stakeholder engagement in decision making at different scales strengthens legitimate representation, empowers people, and makes the water governance

[7] Principle is here understood as a fundamental declaration of values, in relation to a specific issue, which functions as a guide that explains how something works (adapted from Ashton *et al.,* 2006).

system more responsive to local issues (Rogers & Hall, 2003; Peña & Solanes, 2003; WWAP, 2003, 2006). For a water governance system to be more effective, it is necessary for stakeholders to have clear and regular communication (both vertically and horizontally). Concerning non-government stakeholders in particular, it is essential to have a fluent exchange of information between stakeholder representatives and the groups they represent, and vice versa (WWAP, 2006, 2012). For a water governance system to be viable, it is important that all voices are heard and all interests represented, especially in cases with marginalized and disadvantaged groups (Rogers, 2002; Moench *et al.*, 2003; Rogers & Hall, 2003; WWAP, 2003, 2006, 2015; Ashton *et al.*, 2005; Ashton *et al.*, 2006; Batchelor, 2007; Tortajada, 2010a; FAO, 2013). Inclusive stakeholder engagement also encourages cooperation and collaboration, and has the potential to improve the likelihood of success in achieving set goals (Rogers & Hall, 2003; Peña & Solanes, 2003; WWAP, 2003, 2006; Falkenmark *et al.*, 2004; Ashton *et al.*, 2005; Saravanan *et al.*, 2009). Public participation could result in transparency, legitimacy, accountability, equity, efficiency, responsiveness, flexibility, continuity, and cohesiveness in water governance system.

Based on the clusters of literature reviewed on participation and other related concepts, *participation* in the current thesis will imply inclusive and legitimate multi-stakeholder representation in water-related decision making forums. Additionally, these stakeholder representatives should speak and/or act in the best interest of the groups they represent while valuing the interests and perspectives of other stakeholders.

(b) *Coherence:*

Water governance systems should ensure that policies, plans, programs, regulations and actions in the water sector are coherent, consistent, and clear. It should also avoid ambiguity by ensuring that various initiatives do not have conflicting goals (Rogers & Hall, 2003). Achieving these goals requires a clear definition of stakeholder roles and responsibilities to help facilitate collaborative and well-coordinated stakeholder action (Moench *et al.*, 2003; WWAP, 2003; UNDP, 2004; Ashton *et al.*, 2006; Biswas & Tortajada 2010, 2010a; WGF, 2012), and to avoid overlapping or contradictory roles that often result on conflicts (Rogers & Hall, 2003; WGF, 2012). It is also important that roles are matched with authority and responsibility, and that institutions and organizations at all scales have the necessary financial, human and other logistical capacities to carry out their

roles and responsibilities effectively (WWAP, 2003; Solanes & Jouravlev, 2006; Batcheor, 2007). While individual stakeholders and their respective roles are important, the principle of coherence also requires that information be shares among stakeholders in order to encourage the coordination of activities, and create synergies in the implementation of solutions to common water management concerns (Rogers & Hall, 2003; Solanes & Jouravlev, 2006; Dore *et al.,* 2012; WWAP, 2015).

To be effective, water governance systems should have the capacity to adequately respond to anticipated problems and solve existing water resource issues. Water governance systems depend largely on their ability to make decisions and act at the most appropriate level (subsidiarity principle), making the system effective and timely, delivering what is needed when and where it is needed; while making the best use of resources to improve overall outcomes (Rogers & Hall, 2003; WWAP, 2003, 2006, 2015; Ashton *et al.,* 2005; Conca, 2006; Tortajada, 2010a; WGF, 2012). Proximity to the source of the problems allow stakeholders and their decisions to be more in tune with the context in which issues present themselves (Rogers & Hall, 2003; WWAP, 2003, 2006, 2015; Conca, 2006; Tortajada, 2010a). Therefore, the devolution of power and authority to lower levels of government and civil social organizations, and the creation of water governance forums (such as river basin councils), could allow for decisions to be made and actions to be taken at the lowest relevant level of social aggregation, while using the basin as a planning unit. Regional and local authorities, as well as organized water users, should get increasingly involved in water management, which would make it easier for institutions and processes to adapt to change, while ensuring that there is a clear social, economic and environmental gain to be achieved by following enacted policies (Carr *et al.,* 2014; Gallego-Ayala & Juízo, 2014; Grecksch, 2015).

Grounded in the discussion of literature around the issue of coherence, *coherence* as used in the current study will refer to the facilitation of well-coordinated actions and stakeholder collaborations at all scales in order to deliver what is needed when and where it is needed, while making the best use of available resources. This requires that stakeholder roles are clearly defined and well matched with the delegation of authority and responsibility. As well, stakeholders should have the capacity to carry out their duties

effectively. These aforementioned actions should result in the effective management of water resources.

(c) *Rule of Law:*

Sound water governance requires a strong and clear regulatory and administrative framework to regulate planning, development, management and the equitable allocation of water resources (Rogers, 2002; Moench *et al.,* 2003; Rogers & Hall, 2003; WWAP, 2003, 2006; UNDP, 2004; Tortajada, 2010a; Grigg, 2011). Laws, norms, regulations, treaties, agreements, protocols, management plans, and property rights are tools that provide legitimacy, clarity, transparency and credibility to the water governance system while reducing arbitrary actions and decision making (Rogers, 2002; Rogers & Hall, 2003). The "rules of the game" and the consequences for violation of those rules need to be clear and easily accessible to all citizens (Rogers, 2002; Rogers & Hall, 2003; Batchelor, 2007). Formal (statutory) and informal (customary) rules are aimed at providing security, certainty, and transparency in water governance systems, while reducing arbitrary decision making, mitigating conflicts, and minimizing corruption (Moench *et al.,* 2003; Rogers & Hall, 2003; WWAP, 2006; Batchelor, 2007). It is essential that the rules specify what is allowed, what is not allowed, the penalties for wrongdoing or misconduct, and who has the authority to enforce them and to what extent (Rogers, 2002; Rogers & Hall, 2003). Water governance requires that authority be legitimately exercised only in agreement with publicly disclosed laws (formal and informal), which are adopted and enforced in accordance with established procedures. Penalties should be equitably applied for wrong doing to all stakeholders and stakeholder groups in a manner that encourages accountability and a sense of responsibility (Rogers, 2002; Rogers & Hall, 2003). Gaps and contradictions in the rules of the game should be avoided, since they make regulatory frameworks less effective, and provide opportunities for corruption and abuses (WWAP, 2003, 2006; UNDP, 2004; Funder *et al.,* 2010).

Effective water governance requires clarity concerning the roles and responsibilities of all the institutions, organizations, actors and networks involved in developing, implementing, and evaluating policy, at all levels (Moench *et al.,* 2003; Rogers & Hall, 2003; WWAP, 2003; UNDP, 2004; Ashton *et al.,* 2005; Biswas & Tortajada 2010; Tortajada, 2010a; WGF, 2012). Conditions in which contradictory roles are merged under

a single authority, like being provider and regulator of services, should be avoided because they create operational and credibility problems (Rogers & Hall, 2003; WWAP, 2006; Batchelor, 2007; Griggs, 2011; Jacobson *et al.*, 2013). A clear system of oversight and checks and balances should be established, to monitor compliance with the law and with stakeholder's responsibilities, and help avoid abuse of power by authorities or local elites (Rogers & Hall, 2003; Jacobson *et al.*, 2013). Water governance systems also need well defined water governance forums with built-in arbitration, monitoring and enforcement mechanisms, which could help with the resolution of conflicts associated with water resources (Rogers, 2002; Rogers & Hall, 2003). Having roles and responsibilities clearly defined brings transparency to a water governance system, and strengthen with a system of oversights and establishing checks and balances. This in turn allows government officials, institutions and other stakeholders to be held accountable for their actions, decisions and/or omissions (Rogers, 2002; Rogers & Hall, 2003; WWAP, 2003; Tortajada, 2010a; WGF, 2012; Jacobson *et al.*, 2013).

Water governance must be strongly based upon the ethical[8] principles and context of the society in which it functions and rooted in the rule of law (Rogers, 2002; Rogers & Hall, 2003; WWAP, 2003, 2006; Batchelor, 2007). It is important to consider local context (i.e., cultural, social, economic, political conditions), since unique conditions in specific contexts remain determinants of the viability of water legislation, policy and regulations and their respective outcomes. This is particularly critical when attempting to implement an imported water governance model (Moench *et al.*, 2003; Biswas & Tortajada, 2010; Hornidge *et al*., 2013; Jacobson *et al.*, 2013; OECD, 2015; Mapedza *et al.*, 2016; Rola *et al.*, 2016). Not taking local context into consideration when developing and implementing institutional and policy reforms could weaken the water governance system instead of strengthening its functionality (Hornidge *et al.*, 2013; Jacobson *et al.*, 2013; Mapedza *et al.*, 2016; Rola *et al.*, 2016).

As evidenced in the review of literature, the concept of *rule of law* has many components. This principle will be used in this thesis to denote the existence of strong and clear regulatory and administrative frameworks (both formal and informal) that are rooted

[8] Ethical is here understood as a system of accepted beliefs that conform to moral principles of what is right and wrong behavior.

in the socio-cultural contexts within which they function. It requires legitimacy in exercising authority and also requires that stakeholders are held accountable for their actions through the impartial application of penalties. It requires that roles involving power and authority are distributed in conjunction with checks and balances. The existence of arbitration forums for conflict resolution should also characterize the rule of law.

(d) *Knowledge:*

For water governance systems to function effectively, it is necessary that all actors and stakeholders communicate with each other in very direct ways (Rogers, 2002; Rogers and Hall, 2003). Dialogue and negotiations are a cornerstone of a successful water governance system; therefore, it is important to have relevant current and historical information that is relevant for making decisions around water resources (e.g. quantity and quality of surface and groundwater resources). This information should be made available to actors, stakeholders and the general public for scrutiny and evidence-based decision making (UNDSD, 2002; Rogers & Hall, 2003; Solanes & Jouravlev, 2006; Biswas & Tortajada, 2010a; WWAP, 2012, 2015). The mobilization of knowledge among stakeholders can yield decisions that are more fruitful and likely to achieve better outcomes that meet diverse stakeholder needs in an equitable manner (Rogers & Hall, 2003; Ashton *et al*., 2006; Solanes & Jouravlev, 2006; Dore *et al.*, 2012; WWAP, 2015). Stakeholders should work in a clear and open manner, actively communicating about what they do and the decisions they are taking, using clear and simple terminology, hence making all policy formulation and decision-making processes easy to follow by both insiders and outsiders. This will enhance the quality of water governance by promoting transparency, clarity, confidence, and credibility (Rogers, 2002; Rogers & Hall, 2003; WWAP, 2005, 2006; Ashton *et al.,* 2005; Ashton *et al.,* 2006; Batchelor, 2007). This open flow of information not only facilitates a more effective coordination of collaborative activities both vertically and horizontally, but also provides the opportunity to hold institutions, organizations and actors accountable for their actions and decisions by monitoring progress (Rogers & Hall, 2003; Solanes & Jouravlev, 2006; Tortajada, 2010a; WWAP, 2015).

An effective water governance system also utilizes communication and information systems for educational purposes. Disseminating information through formal and informal educational programs could increase awareness over a wide range of issues at local,

regional, national and international levels, among stakeholders and the general population (Rogers, 2002; Moench *et al.,* 2003; Rogers & Hall, 2003; WWAP, 2003, 2012, 2015; Biswas & Tortajada, 2010a; FAO, 2013). Learning about water issues in other sectors or places and about strategies followed to solve water problems, not only aids on building empathy among water users at local and basin levels, but it also helps build consensus among stakeholders on how to achieve common set goals (Rogers & Hall, 2003; Dore *et al.,* 2012). Increased awareness regarding water problems, policies, plans and programs could also increase the levels of stakeholder involvement and the implementation level of success (Rogers, 2002; Rogers & Hall, 2003; Dore *et al.,* 2012).

Based on these multiple perspectives pertaining to knowledge in the literature, the current study deems *knowledge* as making relevant information accessible to all stakeholders and the general public for the purposes of education, decision making, awareness, public scrutiny and capacity building programs. In order to create a level ground for negotiations and quality collaboration, multiple stakeholders should communicate in open and direct ways using simple and clear terminology. This should, in turn, improve decision making, enhance stakeholder collaboration and put stakeholders in the position to make responsible decisions.

(e) *Integration:*

Water governance follows an intersectoral approach that recognises that all water uses and users are interrelated and interdependent, and considers the basin as a planning and management unit (Rogers & Hall, 2003; Ashton et al., 2005; Batchelor, 2007; WGF, 2012; Mitchell, 2013; WWAP, 2015). A viable water governance system takes into account existing and future demands of surface and groundwater resources and their possible impacts to environmental, social, and economic interests within the basin, and considers vital aquatic and terrestrial ecosystems as present and future freshwater users (Rogers & Hall, 2003; WWAP, 2006; Tortajada, 2010a). It is important for policy and decision makers to consider strategies such as the rehabilitation, remediation and restoration of local and regional water cycles, more efficient and effective ways to preserve and protect the quantity and quality of surface and groundwater resources, and reducing risks and hazards associated with extreme weather events, aimed at the sustainability of water resources and

water services in a given river basin (Moench *et al.*, 2003; Rogers & Hall, 2003; WWAP, 2003, 2006; Grigg 2008; WGF, 2012; Mitchell, 2013; WWAP, 2015).

Water governance should be strongly rooted in local traditions and context, taking into account availability and quality of water and associated resources, because they could determine the outcomes of water policies, plans, and programs (Moench *et al.*, 2003; Rogers & Hall, 2003; WWAP, 2003, 2006; Biswas & Tortajada, 2010; Tortajada, 2010a). Changing conditions in space and time require water governance systems to be flexible and be able to adapt and respond to the dynamics established by local contexts (Moench *et al.*, 2003; WWAP, 2003, 2006; Cook, 2014). An effective water governance system should account for existing rights (including informal traditional water rights) and the rights of posterity through the policy- and decision-making process The overall goal of the appropriate water governance system should be to achieve long-term sustainability of water resources (Rogers & Hall, 2003).

Grounded in the above literature, this thesis interprets *integration* as the application of an intersectoral approach that uses the basin as the planning and management unit. It is rooted in local contexts and considers existing and future demands of water resources and their possible impacts on environmental, social and economic interests, while seeking to promote long-term sustainability of water resources.

While each of the five principles described above could independently act as a topic of research, assessing them collectively under a unified framework will paint a holistic picture of water governance and tease out various shortcomings. This thesis analyses all five principles together under a common framework to better understand water governance.

This thesis poses that it is in these basic principles that a unifying definition of water governance can be captured. The principles proposed here, capture critical traits that should be evident in an ideal water governance system. In general terms, they indicate that ideally, a viable water governance system should have a strong regulatory framework that clearly establishes the roles and responsibilities of all stakeholders and holds stakeholders accountable for their actions. They also recognize that relevant information should be made readily available to enable stakeholders negotiate issues on a level playing field, and make informed decisions that respond to the local context. These principles also reflect that decisions should be made close to where problems originate and that top-down and bottom-

up networks need to be established to effectively coordinate stakeholder actions and decisions at various scales. They emphasize the importance of taking the values and interests of all stakeholders (including marginalized groups, ecosystems and future generations) into account during negotiations and decision making. Finally, they insist that decisions be made bearing in mind local conditions while aiming towards long-time sustainability.

2.4 Expected contributions

Water governance involves many scales, stakeholders, capacities and networks (to name just a few), which make it difficult to establish a single assessment framework that addresses all these differences. Researchers have applied several assessment frameworks, mainly approaching water governance from their area of expertise, or according to the nature of their research topic. This has, in turn, resulted in an increase complexity of assessment frameworks. For this reason, this thesis considers that 'going back to the basics' is a fundamental approach to establishing an all-encompassing framework.

The framework proposed here aims to contribute to the literature by integrating the principles from the most complex to the more basic ones. For example, the proposed operational definition for the *Participation* principle includes the former definitions provided in the literature, like: (a) participation of a wide variety of stakeholders, (b) informed participation, to multilevel of cooperation and decision making and equity considerations, when those decisions are applied within the basin (c) equity between and among the various interest groups, (d) multilateral processes of decision making, and (e) collaboration and cooperation (Rogers, 2002; Moench *et al.*, 2003; Rogers & Hall, 2003; WWAP, 2003, 2006, 2015; Biswas & Tortajada, 2010, 2010a; Tortajada, 2010a; WGF, 2012).

The survey mentioned above (Section 2.2), points that most assessments were conducted at the basin scale. The present study considers a good opportunity to test the assessment framework proposed here to assess the conflicts in water management and governance in the Lerma-Chapala river basin. The next chapter presents complexities around water in this region.

Chapter Three

3 Area of Study

3.1 Introduction

Mexico has a long-standing history in water resource planning and management; hence, the country is regarded as a leader in the Latin America context (Dourojeanni & Jouravlev, 2001; Mestre, 2001a; Dourojeanni *et al.*, 2002). The enactment of the National Water Law (NWL) on December 1, 1992 marked an intended shift from a traditional centralized top-down sectoral approach (i.e., *pre-Rio* approach), to an integrated water resource management (IWRM) paradigm (i.e., *post-Rio* approach) (González-Villarreal & Garduño, 1994; Dourojeanni, 2001; Mestre, 2001; Wester *et al*., 2009b; Wilder, 2010). In general, this law embraced concepts such as decentralization, stakeholder participation, collaboration and coordination, water efficiency, polluter pays principle, subsidiarity principle, and full-cost pricing, as well as the integration of surface and groundwater management, and the use of the basin as a management unit (Hearne, 2004; Wester *et al*., 2009b; Wilder, 2010).

Within this thesis, Mexico's Lerma-Chapala basin (LChB) is used as a case study. A major factor that makes the LChB an appropriate case study is the fact that it has been used by the Mexican government as a 'testing ground' for water policy. For example, IWRM which was originally an international policy prescription was first implemented in the basin (Wester *et al*., 2009b). The 1993 Lerma Chapala Basin Council (LChBC) was also the first multi-stakeholder water governance forum in Mexico and Latin America as a whole. Tortajada (2006) describes the LChBC as the most advanced River Basin Council (RBC) in Mexico, though she notes that RBCs were not functional in Mexico by 2006. The process of transitioning to a multi-stakeholder approach to water governance has been challenging, evident in the persistence of issues relating to anthropogenic induced water scarcity, water pollution, and environmental degradation in the basin (Tortajada, 2006; Wester *et al.,* 2008; Wester *et al*., 2009b; WMO & CONAGUA, 2011; Preciado-Jimenez *et al*., 2013; Bautista-Avalos *et al.,* 2014; Delgado-Galvan *et al*., 2014). A major goal of this case study is to apply the developed five-tier framework to further our understanding of how these persistent challenges have stemmed from issues associated with water governance and the implementation of an IWRM reform.

3.2 The physiography of the Lerma-Chapala Basin

The location of Lerma-Chapala basin relative to the rest of Mexico is displayed in Figure 3.1. The River Lerma is the longest inland watercourse in the country (WMO & COAGUA, 2011). The basin has a total area of 47,116 km^2 (CONAGUA, 2014), which is equivalent to 2.4%[9] of Mexico's territory. Its headwaters are located in the State of Mexico at the Chignahuapan Lagoon (Hidalgo & Peña, 2009) at 2,600 masl, and flows north-westerly for about 708 kilometers until it reaches Lake Chapala (1,510 masl), which is the largest natural lake in Mexico (CONAGUA, 2014).

Five states share the area of the Lerma-Chapala basin covering different percentages of the basin's territory: the State of Mexico (11%), Queretaro (6%), Guanajuato (49%), Michoacan (20%) and Jalisco (15%) (CONAGUA, 1991; SEMARNAT, 2004).

Figure 3.1: Geography of the Lerma-Chapala basin

The LChB has a high level of variability with regards to surface water availability. The basin has a yearly average rainfall of 711.5 mm, with regional variations throughout the basin (Figure 3.2). Temporally, rainfall is also highly variable, with a minimum average annual rainfall of 494mm in 1999 and a maximum of 1,022mm in 1958 (CONAGUA, 1999, in Wester *et al*., 2000). This variability, coupled with high population density, urban

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[9] Percentage of area calculated using the total area for Mexico of 1,959,248 km^2 provided in *Atlas del agua en Mexico 2014* (CONAGUA, 2014).

concentration and economic development, has resulted in decreased water quality and availability. Water scarcity and pollution has generated environmental, economic and social problems, which have further triggered conflicts in the region (Preciado-Jimenez *et al.*, 2013). Arguably, the most prominent conflict in the basin pertains to the allocation of surface water. Water resource vulnerability is projected to increase in the LChB, as climate change is expected to decrease surface runoff, aquifer recharge rates, and the annual availability of water (Rivas *et al.*, 2011; Acosta &Martinez, 2014).

Modified from SEMARNAP, 2011.

Figure 3.2: Mean annual precipitation in the Lerma-Chapala basin

3.3 A shift in water management paradigms in Mexico: A policy-based perspective

In addition to the physiography, there are policy components that add to the complexity of water governance in the LChB. The legal framework for governing water resources in Mexico draws its authority from the Mexican Constitution of 1917, with which Article 27 legitimizes the State as the sole owner of all land and water resources. Historically, water management in Mexico focused on building water-related infrastructure to satisfy sectoral demands, based on a supply-oriented strategy (Garcia, 1999; Wester *et al.*, 2000; Castelán, 2001; Dourojeanni *et al*, 2002; Castro, 2006). Between the 1920s and the 1980s, the federal government supported and aggressive agrarian policy and therefore developed large-scale irrigation systems through the country, including the LChB (SARH, 1984; CONAGUA, 1993a; Estrada Reyes, 1994; Whiteford & Melville, 2002; Castro, 2006; Santos, 2007; Wester *et al.*, 2009b).

The prevailing paradigm during the 20th century in Mexico was that highly centralized and powerful federal government agencies were responsible for all water planning, development and management in the country. In 1926, the National Irrigation

Commission (NIC) became the first federal institution dedicated to water policy, enabling the federal government to plan and develop water infrastructure in the country (i.e., large dams and irrigation networks) from a highly centralized institutional structure (Whiteford & Melville, 2002; Castro, 2006; Santos, 2007). Then, in 1946, the federal government replaced NIC with the Ministry of Hydraulic Resources (MHR), which became the first public institution at the level of federal cabinet exclusively dedicated to governing water resources. The MHR approached governance based on a centralized and technocratic institutional framework (Whiteford & Melville, 2002; Castro, 2006; Wester, 2009; Wester *et al.*, 2009c).

In 1976, water functions were subdivided among different government agencies. On the one hand, MHR merged with the Ministry of Agriculture and Livestock to create the Ministry of Agriculture and Hydraulic Resources (MAHR). On the other hand, all the responsibilities associated with drinking water and sanitation services were transferred to the newly created Ministry of Human Settlements and Public Works (MHSPW), and then moved to the Ministry of Urban Development and Ecology (MUDE) in 1983. Several authors mention that this institutional rearrangement emphasised sectoral differences, and consequently this separation of water planning, management and development activities between two federal ministries made coordination efforts difficult (Mestre, 1997; Whiteford & Melville, 2002; Tortajada, 2005; Tortajada & Contreras-Moreno, 2007).

Several internal and external events led Mexico to change its centralized, sector- and supply-oriented water policy during the 1980s. On one hand, there were the financial constraints caused by repeated economic crises. On the other hand, a radical transformation in the conception of the role of the state by international development and financial agencies was taking place (Castro, 2006). This was, in part, driven by requirements for funding that were imposed by the World Bank (WB) and the International Monetary Fund (IMF), resulting in the Mexican State modifying its centralized hierarchical bureaucratic model with a series of structural changes that included a decentralization process (Rodriguez, 1997; Hamnett, 2006; Buchenau, 2008), and the devolution of power from the centre to lower levels of government (Rodriguez *et al.*, 2003; Castro, 2006; Sanchez Mesa, 2006). For example, reforms to Article 115 of the Mexican Constitution in 1983 permitted the transfer of responsibilities for drinking water, drainage and sanitation services utilities from

federal to state and municipal governments (Ingram *et al*., 1995; Rodriguez, 1997; Pineda Pablos, 2004; Castro, 2006; Sanchez Mesa, 2006). Consequently, MUDE and other federal institutions began to open state offices in the mid-1980s, to aid in the transfer of power to local scale (Rodriguez, 1997 Tortajada, 2005; Tortajada & Contreras-Moreno, 2007; Hidalgo & Peña, 2009).

Following the above-mentioned events, the National Water Commission (NWC) was created on January 1989, becoming the sole water authority in the country responsible for growing water related problems. The economic crises of the 1980s had left the water sector in a critical state, and by the end of the decade water infrastructure was in a state of disrepair (Buras, 1996). By the late 1980s, water scarcity, unsuitable water allocation, water pollution, environmental degradation and a host of other problems worsened. The NWC was created with a mandate to define a new policy for water resource management and a new water law to solve water related problems (Johnson, 1997; Mestre, 2001; Pérez Prado, 2003).

The enactment of the National Water Law (NWL) in December 1992 arguably marked the most significant paradigm shift in Mexico's water management approach. This shift was marked by the attempt to move further away from a the traditional top-down centralized sectoral approach, and into an IWRM approach (González-Villarreal & Garduño, 1994; Dourojeanni, 2001; Mestre, 2001; Wester *et al*., 2009b; Wilder, 2010). A partial explanation for this shift is offered by Wilder (2010), who states that Mexico's federal government was under pressure to modernize its water policy framework during the negotiations of the North American Free Trade Agreement (NAFTA), in 1992. This law demanded decentralization in the water sector, the adoption of a subsidiarity principle, the engagement of multiple stakeholders in decision making, the creation of RBCs, the establishment of collaboration and coordination networks, as well as the integration of surface and groundwater management, and the use of the basin as a management unit (Hearne, 2004; Wester *et al*., 2009b; Wilder, 2010). For example, Article 13 of the NWL states that the NWC "will establish RBCs as coordination and consensus-building forums between the NWC, agencies from the federal, state and municipal levels and water users of a given river basin". These forums have the "objective of developing and implementing programs and actions to improve water development, management, and service provision,

as well as the preservation of related resources [i.e., soils, forests, aquatic and terrestrial ecosystems] in the basin" (DOF, 1992: Article 13). Therefore, the RBCs envisioned in the 1992 NWL are consistent with the definition of IWRM provided by the Global Water Partnership (2000:22), as follows: IWRM involves "the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems".

Other changes took place in Mexico's water sector during the 1990s. After the 1994 financial crisis, Mexico needed to comply with 'good governance' and IWRM requirements imposed by the World Bank and the International Monetary Fund, in order to qualify for funds and work its way out of the crisis (Hamnett, 2006; Wilder & Romero Lanko, 2006; Wilder, 2010). One of the changes that took place was the transfer of the NWC from MAHR to the newly created Ministry of the Environment, Natural Resources and Fisheries (MENRF) in 1994. This change transformed the NWC from an agency with sectoral predisposition that was focused on supplying water for agriculture, to an intersectoral system that placed emphasis on issues such as water conservation (Wilder, 2010). In essence, changes that took place in Mexico's water sector during the 1990s marked a shift from a state-oriented top-down approach to a multilevel, multi-stakeholder and collaborative approach to water management.

3.4 Water management in the Lerma-Chapala basin

As part of the agrarian policy that was implemented by the Mexican government between the 1920s and the 1940s, agricultural areas of the LChB increased with the construction of dams and irrigation districts (Ruiz Briseño, 2005; Santos, 2007; Wester, 2009). As result, irrigated area in the basin increased from 155,000 hectares in the 1930s, to 214,000 hectares in the 1950s, and 675,000 hectares in the 1980s (Wester *et al.*, 2008). With regards to drinking water supply, population increased in the basin from 2.1 million in 1930 to 4.5 million in 1970, resulting in an increase in water demand mainly for consumption in urban areas (Wester *et al.*, 2005). Water demand in the LChB also increased by the completion of two major projects that transferred groundwater to Mexico City and surface water to Guadalajara since the 1950s, even though these two cities are located outside the basin area (Caire, 2005; Castro, 2006; Wester *et al.*, 2008). Industrial

development also increased rapidly in the basin in the 1950s and has continued to increase significantly, making the LChB one of the most important industrial corridors in the country (Castelan, 2001; Sandoval, 2004). According to Sandoval (2004), water resources in the LChB had reached equilibrium limits of withdrawal to availability ratio (m^3/person/yr) by the end of the 1970s. Wester, Scott and Burton (2005) mention that by the mid-1980s, the consumption of surface and groundwater by agriculture, industry and municipalities was more than was renewably available, thus creating a condition known as river basin closure. These examples illustrate how the federal government implemented water demand and use policies in the basin.

By the end of the 1980s, issues associated with the deteriorating quantity and quality of water resources in the LChB needed be addressed. With regards to quantity, several authors agree that water resources in the basin were over-committed (Barker *et al.*, 2000; Mestre, 2001; Wester *et al.*, 2005; Wester *et al.*, 2008; Hidalgo & Peña, 2009), while formerly rich aquifers were being over-exploited (Mestre, 1997; Wester *et al.*, 2000; Mestre, 2001; Wester *et al.*, 2005). Pertaining to water quality, Mestre, Leon and Martinez (1994) stated that untreated municipal and industrial wastewater discharges were added to the existing flow of the River Lerma and its tributaries, and by the end of the 1980s, the LChB was considered as the most polluted basin in Mexico (Figure 3.3). Pressing problems such as increasing water demand, water scarcity, groundwater over-exploitation, low water efficiencies, surface and groundwater pollution, land use change, deforestation, and soil erosion, still prevail in the basin (Mestre, 1997; Castelan, 2001; Sandoval, 2004; Wester *et al.*, 2008; WMO & CONAGUA, 2011; Estrada Godoy *et al.*, 2013; Preciado-Jimenez *et al.*, 2013; Bautista-Avalos *et al.*, 2014; Delgado-Galvan *et al.*, 2014).

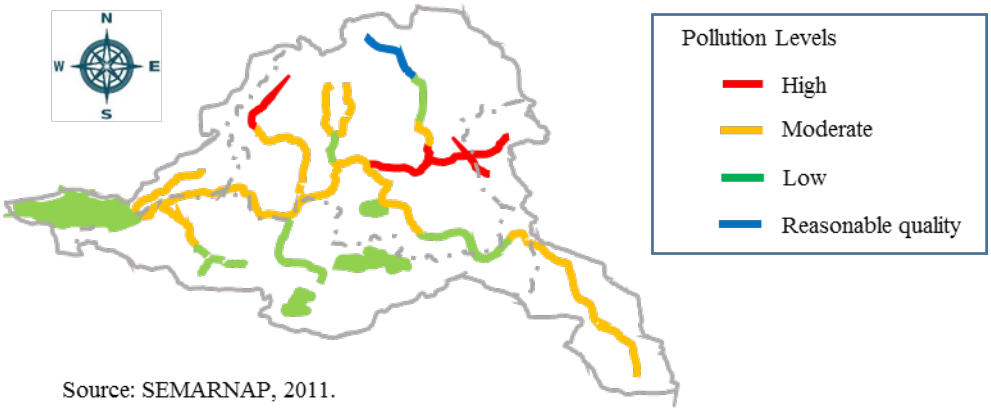


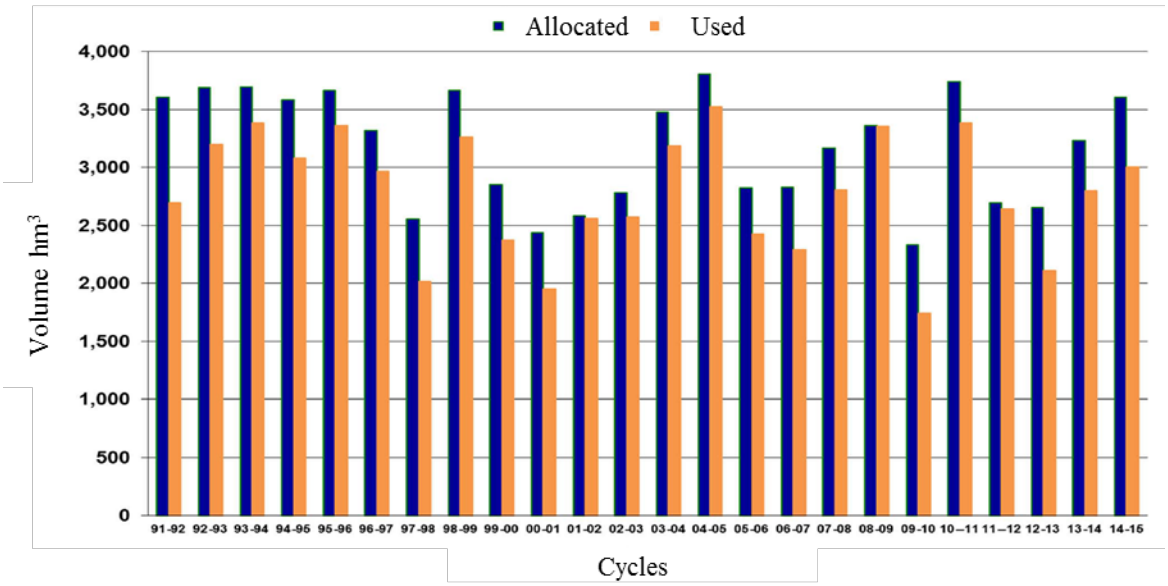
Figure 3.3: Surface water pollution levels in the Lerma Chapala Basin

3.5 Institutional and resource based conflicts

Institutional conflicts and direct resource use conflicts are the two central types of conflicts that have emerged in the LChB. The main conflict in the LChB exists between the states of Guanajuato and Jalisco (Figure 3.1) and pertains to the allocation of surface water resources (specifically surface water from the Solis dam). The first Lake Chapala crisis revealed that the basin had reached its limits of water availability, as a period of lower than average rainfall[10] resulted in a prolonged drought (1945-1958) and lake storage levels declining from an average of 6,429 million of cubic meters (hm^3) between 1935 and 1945, to its lowest recorded level at 945 hm^3 in 1955 (Wester, 2009; Wester *et al.,* 2008). Santos (2007) explains that many people form Jalisco associated low water levels in Lake Chapala with the inauguration of the Solis dam (the largest in the basin) in 1949. Tensions increased as Jalisco appealed for the health of the lake ecosystem and Guanajuato defended the interests of its agricultural users. This ecological/agricultural conflict resurges during times of drought.

The second Lake Chapala crisis began in 1994, and the NWC responded by transferring volumes of water from the Solis dam to Lake Chapala. During this crisis, lake levels dropped critically to the second lowest recorded levels in history in 2002, (Escobar, 2006; Wester *et al*., 2008). The first transfer of surface water took place in 1999 (200 hm^3) before members from the irrigation districts joined the LChBC. A second transfer was authorised in 2001 (270 hm^3) but this time it was met with resistance from agricultural water users. Finally, a third transfer took place in 2003 (270 hm^3) regardless of strong opposition from the Board Member for the agricultural use to the LChBC (Wester *et al.*, 2008). Figure 3.4 shows the volumes of surface water allocated and used in the LChB from 1991 to 2015. Today, the availability and allocation of surface water remains the most disputed issue in the Lerma-Chapala Basin Council (LChBC). (See Wester, 2009, Wester *et al.,* 2007; Wester *et al.,* 2008, and Wester *et al.,* 2009b for further reading). For example, due to the transfer of vast volumes of water from Lake Chapala to the city of Guadalajara, conflicts have emerged between individuals living around the lake and those in Guadalajara.

[10] Average rainfall in the Lerma-Chapala basin for the period 1935-1944 was 683 mm, while for 1945-1958 it was 626 mm (from Paula Sandoval, 1994, in Wester, 2009).



Source: Organismo de Cuenca Lerma-Santiago-Pacífico, 2015.

Figure 3.4: Surface water allocated and used (cycles 1991/1992 – 2014/2015)

Another conflict that exists in the LChB is the transfer of groundwater from the headwaters of the River Lerma in the State of Mexico to the adjacent basin, which is the Mexico City valley. Since 1950s, approximately 323 hm^3 of water was extracted from underneath the wetlands of the River Lerma annually (Wester *et al.*, 2000; Wester *et al.*, 2008). Decades of exploitation reflect a steady decline of piezometric levels of 1 to 3.5 m/year, which in turn resulted in the desiccation of three lakes, the loss of aquatic ecosystems, the drying up of springs, a decrease of river flows, and land subsidence in the Valley of Toluca (Esteller & Diaz-Delgado, 2002). This conflict involves the federal government on one hand and the State of Mexico on the other hand. Traditionally, this ecological/urban conflict has been addressed bilaterally and treated as a localized problem (Santos, 2007). The overexploitation of groundwater resources at the headwaters of the River Lerma and the desiccation of these wetlands could have an impact down-river. However, this problem is seen by Council members as only pertaining the State of Mexico, and therefore is not discussed in the LChBC.

With regards to institutional conflicts, the best example is between the government of Guanajuato and the federal government. One of the most urgent water problems in the LChB is groundwater overdrafting (Wester *et al.*, 2005); nonetheless, the number of overexploited aquifers in the LChB continues to increase. In 2001, Mestre (2001a) reported

that almost 70 percent of all 38 aquifers in the LChB had been overexploited, and in 2014, the NWC reported that 30 aquifers (80 percent) had been overexploited (Figure 3.5) (CONAGUA, 2014). This problem is more acute in Guanajuato, which represents 49 percent of the basin's surface area, and has close to 17,000 deep-water wells, with a significant deficit in groundwater balance estimated at over 1,000 hm^3 per year, that reflects an average of yearly drawdown groundwater level of two to three meters per year (CEAG, 2001a; Sandoval, 2004).

Figure 3.5: Overexploited Aquifers in the Lerma-Chapala Basin

In January 1993, the NWC and the five state governments in the basin signed a coordination agreement to help cope with water problems in the basin. Among other things, this document recognised the need to reduce or stop groundwater overexploitation, and included the development of regulations for aquifers within the LChB (CONAGUA, 1993; Mestre *et al*., 1994; Mestre, 1997). In 1995, the state of Guanajuato, aware of the relevance of water resources for economic development and social well-being, began organizing water users and creating Technical Water Councils (COTAS), expecting them to play an active role in the preservation of their aquifers (Castelan, 2000; Guerrero Reynoso, 2000; Marañon, 2002; Wester *et al.*, 2009a). The NWC created three Technical Groundwater

Committees[11] in 1998, while Guanajuato created fourteen Technical Water Councils (11 within the LChB) between 1997 and 1999, encompassing the entire territory of the State of Guanajuato (Guerrero Reynoso, 2000; Sandoval, 2004; Wester *et al.*, 2009). Guanajuato did this without an active involvement of the NWC, hence, the NWC did not recognize or support these COTAS. Though they have won recognition by the NWC through the years, there has been no delegation of responsibilities to manage groundwater (Maganda, 2003; Wester *et al.*, 2009a). In this sense, Wester, Hoogesteger and Vincent (2009a) indicate that COTAS in Guanajuato cannot self-regulate and reduce groundwater extractions before solving the institutional disputes over water control between the state and federal governments. This institutional conflict limits the level of participation of water users in reducing groundwater overexploitation, and consequently restricts progress in the implementation of water governance in the basin.

3.6 Strategies to confront water management problems (1983-1992)

A number of strategies have been implemented by the federal government to address problems like water scarcity and pollution. These strategies include: (a) legal reforms that bring together state and municipal (local) governments as stakeholders in water management, (b) signing collaborative agreements at the basin level; and (c) structural reforms to decentralize water authority.

One strategy involves a major legal reform, which took place in 1983. Reforms to Article 115 of the Mexican Constitution permitted the transfer of responsibilities for drinking water, drainage and sanitation services utilities from the federal level to state or municipal governments (Ingram *et al*., 1995; Rodriguez, 1997; Pineda Pablos, 2004; Castro, 2006; Sanchez Mesa, 2006). State and municipal governments began to participate in water management activities, before 1983 the federal government was responsible for these activities. In Jalisco and Querétaro, urban water services were transferred to the state governments, while in Guanajuato, the State of Mexico and Michoacán, the transfer was to municipal governments (Pineda Pablos, 2004). However, various authors point out that this decentralization process was only partial because there was no transfer of federal funds to carry out these new municipal responsibilities efficiently, which partly resulted from

[11] Regardless of the name difference, authors use the Spanish acronym COTAS indistinctively for both water user organizations.

Mexico's severe economic crises of the 1980s (Ingram *et al*., 1995; Pineda Pablos, 2004; Castro, 2006; Sanchez Mesa, 2006). This decentralization efforts were strengthened during the 1990s.

A second strategy was adopted on April 1989, when the NWC introduced a new approach to dealing with pressing water management issues in the LChB, mainly the high pollution levels of the River Lerma and the drying up of Lake Chapala (Mestre *et al*., 1994; Mestre, 1997; Wester *et al*., 2000). Before, the federal water authority would act independently to achieve its goals and objectives. In this new approach, the federal government joined efforts with all five state governments within the basin and signed a collaboration agreement to promote a coordinated development of water uses and clean up the basin. Four main objectives of the agreement were: (a) to develop and establish a new water allocation policy, (b) to improve water quality and reduce pollution, (c) to improve water efficiencies, and (d) to preserve the resources and ecosystems of the basin (CONAGUA, 1991; Mestre *et al*., 1994; Mestre, 1997; Wester *et al*., 2000; Castelán, 2001; Sandoval, 2004). On a practical level, they agreed to build and operate 48 treatment plants in what is known as the *First Wastewater Treatment Stage* (Mestre, 1997), which was an urgent step towards solving conflicts related to water pollution.

By September 1989, the NWC and the five state governments created a Consultative Council[12] to review and assess the completion of goals and actions relative to the objectives in the agreement. Some of the main objectives established in the agreement have been achieved, like the signing of the *Agreement on Availability, Distribution and Water Uses* of the LChB in August 1991 and the construction of the 48 wastewater treatment facilities, while others remain in progress. It is important to highlight that all tasks and activities associated with the Consultative Council were carried out by the federal and state agencies (Mestre, 1997). There was no participation from water users or other stakeholders in decision making, nor in the negotiations that resulted in the 1991 allocation agreement.

A second collaborative agreement was signed by the members of the Consultative Council on January 1993. This agreement confirmed the intentions of the Council to to improve water efficiency, and preserve the resources and ecosystems within the basin,

[12] With the publication of the 1992 NWL, the Consultative Council was transformed into the Lerma-Chapala Basin Council in 1993.

which were established in the first agreement. Finally, it aimed to regulate the use, exploitation and development of groundwater in the LChB and establish a *Second Wastewater Treatment Stage,* which included the construction of 52 wastewater facilities (CNA 1993; Mestre et al, 1994; Mestre, 1997). Besides confirming the need to improve sanitary conditions in the basin, this agreement also recognized that more groundwater was being pumped from the aquifers than was being recharged (CNA, 1993), and provided the basis for the creation of COTAS.

A third strategy was implemented during the 1990s, in response to the enactment of with the 1992 NWL and to the federal government's decentralization policies (Mestre, 1997; Castelán, 2001). Decentralization strategies for the water sector included: (a) the decentralization of functions and powers from the NWC's headquarters in Mexico City to 13 Regional Management Offices (Figure 3.6), to ensure that all coordination and organization issues involving water management could be handled at the river basin scale (Tortajada; 2006; Scott & Banister, 2008; Wilder, 2010); and (b) the creation of 26 River Basin Councils (Figure 3.7) in the form of water governance forums, were stakeholders (e.g., NWC, government officials and water user representatives) could build consensus and coordinate actions and programs to improve water management practices at the basin (González-Villarreal & Garduño, 1994; SEMARNAP, 1996; Dourojeanni *et al*., 2002; Parrado Diez, 2004; CONAGUA, 2014).

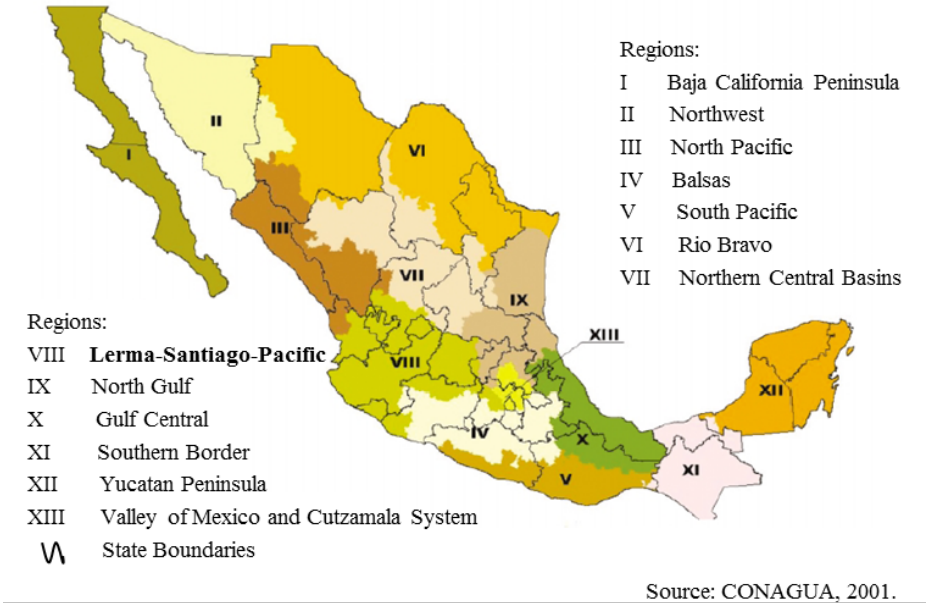


Figure 3.6: Hydro-administrative Regions in Mexico

These three strategies significantly changed Mexico's approach to water management. Between 1983 and 1992 the federal government ceased to be the sole player in overseeing water related issues in Mexico, as state and municipal authorities, and water user representatives started assuming these roles. With these three strategies Mexico began its transition from the traditional authoritarian *pre-Rio* model to a more flexible one in which multiple stakeholders were involved in decision making processes. The increase in stakeholder participation signals an embracement of the *post-Rio* concept of water governance.

3.7 Establishing a water governance forum: the Lerma-Chapala Basin Council

As a result of the 1992 National Water Law drawing attention to institutional structures for water management, the LChBC was created on January 28, 1993. Article 13 of the NWL describes River Basin Councils (displayed in Figure 3.7) as water governance forums, where stakeholders (i.e., three levels of government and water user representatives) can defend their interests, discuss their differences, and (where possible) reach agreements to collaborate and coordinate their activities and projects to improve the development, management, and preservation of water and associated resources in the basin (DOF, 1992, 2004).

Figure 3.7: River Basin Councils in Mexico

Though the NWL was enacted in December 1992, there was no official structure for RBCs until 1994; hence, only government officials participated in RBCs. The first basic structure for RBCs was provided in Article 15 of the mandatory Regulations of the National Water Law (RNWL) (DOF, 1994). Article 15 of the RNWL was later amended in 1997, reducing the rank and number of government representatives while increasing the number of water user representatives (DOF, 1997). It was not until 1997 that Mexican legislation allowed water users in the basin to participate in equal numbers as government representatives in the Lerma-Chapala Basin Council.

An important component of the Council was the establishment of a more detailed official structure (Figure 3.8) and roles, after the publication of the Basin Council Organization and Operation Rules (BCOOR) in July 2000. These organizational and operational rules were aimed at bringing more transparency and clarity to the River Basin Councils (RBCs). It is important to clarify that the NWC's hydro-administrative regions (Figure 3.6) normally cover more than one RBC, and are intended to help resolve conflicts that arise between RBCs. The main objective of these rules was to regulate the activities and procedures that govern the organization and operation of RBCs (Article 1-BCOOR). According to these 'rules,' the LChBC has five main objectives:

- to achieve a balance between supply and demand of water resources throughout the basin, for all uses;
- to prevent, stop or rehabilitate pollution on surface and groundwater to achieve sanitary conditions;
- to conserve and enhance land and aquatic ecosystems in the basin;
- to promote sustainable and efficient use of water resources throughout the water cycle; and,
- to promote a "water culture" which views water as a vital and scarce resource, with economic, social and environmental value and encourage public participation to achieve sustainable water use (CONAGUA, 2000, 2003a).

These main objectives, as with Article 13 of the 1992 NWL are also consistent with the Global Water Partnership's (2000) definition of IWRM.

The structure of the Lerma-Chapala Basin Council established in the 'Basin Council Organization and Operational Rules' (CONAGUA, 2000) included the participation of

various stakeholders, including representatives from the main water uses in the basin, as well as federal, state and municipal governments. The structure of the LChBC (Figure 3.8) has six main components:

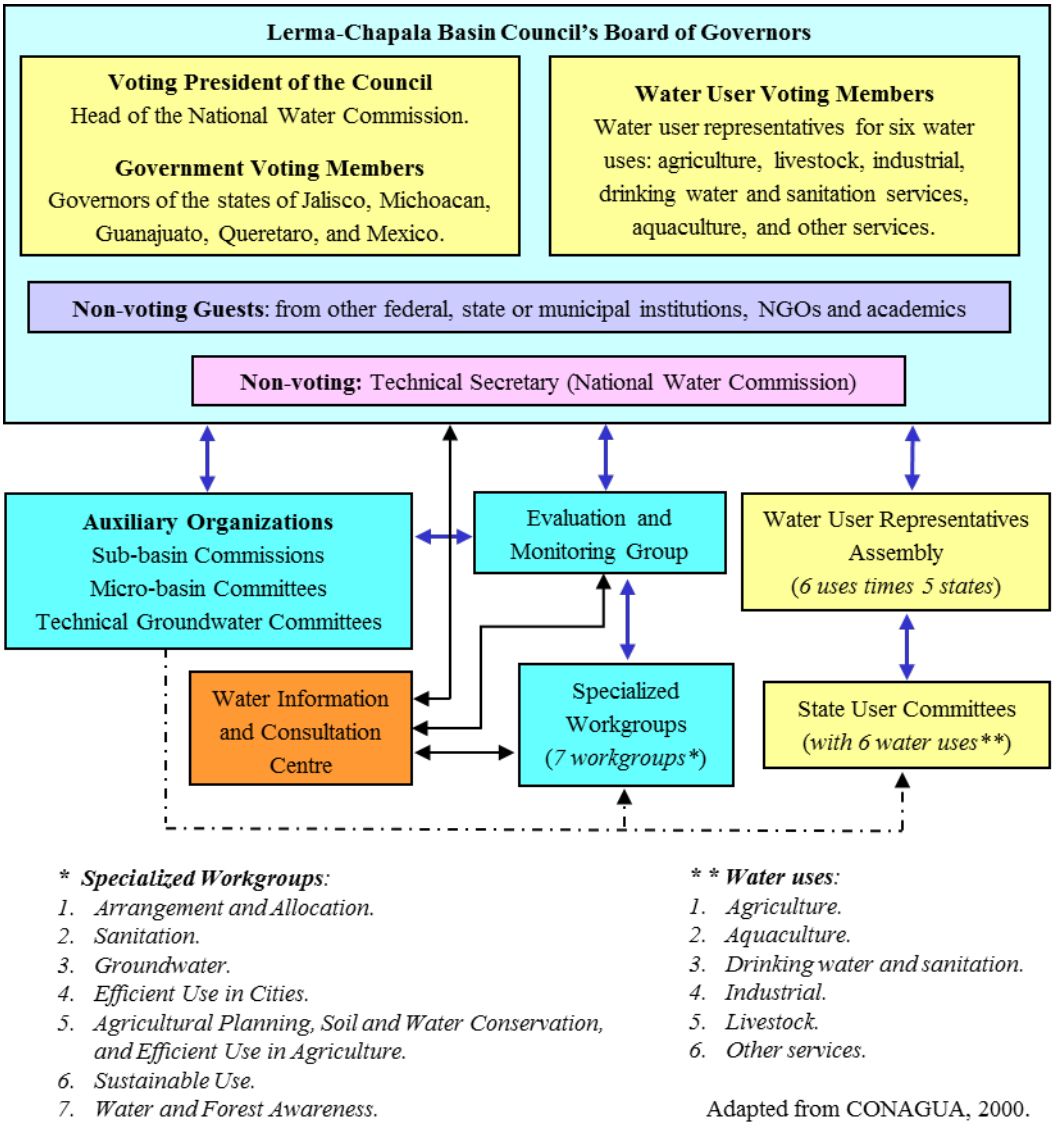


Figure 3.8: Structure of the Lerma-Chapala Basin Council (2000-2008)

a) The Board of Governors: this is composed of the head of the Director General of the NWC, the governors of the five states in the basin, and the elected water user representatives for the six water uses recognised in the basin. In total, there are six government and six water user representatives with voting rights, thus complying with the structure established in the mandatory Regulations of the NWL (DOF, 1997).

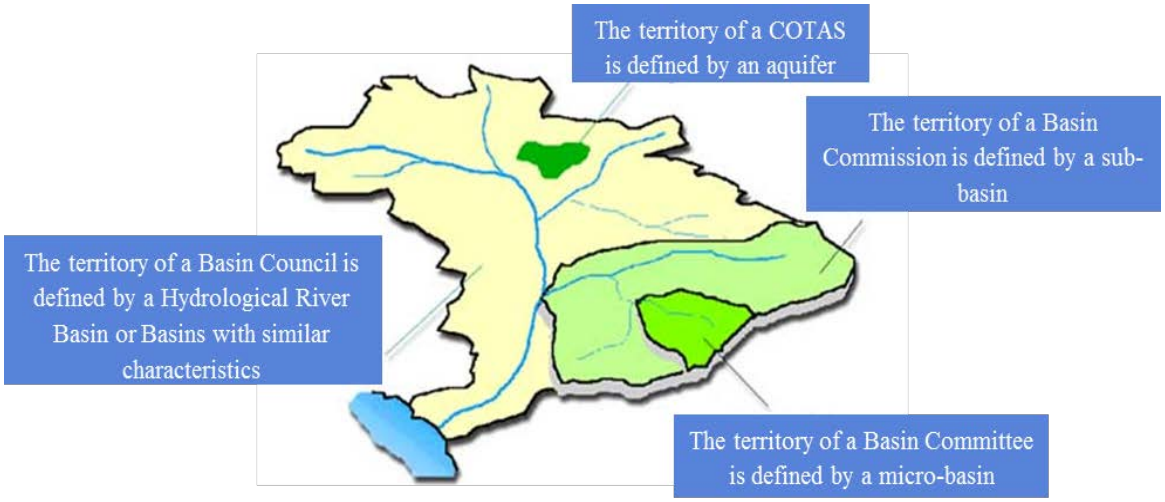
b) The Evaluation and Monitoring Group: this represents the Council's operational branch, and its role is to track all Council's agreements and actions, gather data and information to be used for further agreements, and assist in decision making (Article 22–BCOOR). The group consists of representatives of the state governments, a representative of the Director General of the NWC, the Technical Secretary of the Council and the water users' Board Members (Article 23–BCOOR).

c) Specialized Workgroups: these, are created by the Evaluation and Monitoring Group with the purpose of carrying out special tasks assigned to them by the group. Council members are welcome to join these groups (Article 22- BCOOR). There were seven Specialized Workgroups established in the LChBC in 2008.

d) An Information and Consultation Centre: this centre closed in 2004 (Silva Jimenez, 2005) and had not reopened in 2008.

e) The Water User Representatives' Assembly: this is where the basin's water users elect their representatives to the Board of Governors (Article 48-BCOOR).

f) Auxiliary Organizations: these are smaller administrative units such as Basin Commissions, Basin Committees and Groundwater Technical Committees (COTAS), whose work pertains to sub-basins, micro-basins and aquifers, respectively (Figure 3.9). They are spatial components of RBCs that attempt to bring decision making to the lowest level of social aggregation by promoting water user participation in order to preserve water resources and contribute to water planning.



Adapted from CONAGUA, 2000.

Figure 3.9: Spatial Components of River Basin Councils

This general structure seems to provide the different stakeholders of the basin with the opportunity to be engaged in discussions and negotiations involving planning, development and management of surface and groundwater resources in an integrated manner. As shown in this section, there are multiple water user representatives for each state in the basin, as well as the federal and state government representatives involved in the LChBC. Additionally, stakeholder roles within the basin have evolved over time.

3.8 Auxiliary Organizations: stakeholder engagement at the local level

In 1997, the National Water Commission (NWC) began promoting the organization of water users in the LChB. By then the State of Guanajuato had already started its own organizational process (Castelan, 2001; Marañon, 2002; Scott & Banister, 2008). NWC created three COTAS in 1998, while Guanajuato created eleven COTAS in the LChB between 1997 and 1999 (Guerrero Reynoso, 2000; Sandoval, 2004; Wester *et al.,* 2009a). There was no specific mention of COTAS in the 1992 NWL, nor in the 1994 mandatory Regulations of the NWL or its 1997 amendment. Guanajuato acted independently and without the involvement of the NWC in the creation of COTAS, which occurred before the publication of the BCOOR in 2000. Table 3.1 lists all COTAS in the LChB to December 2013. These implementation differences resulted in differences between COTAS in Guanajuato and those created by the NWC, mainly in their objectives, general structure, and funding sources. The most important difference, from a water governance perspective, is variations in the level of participation. On one hand, the NWC expected groundwater users to participate in water management only for consultation purposes, which implied that the consideration of opinions and concerns of its members in developing policies and strategies was discretionary (Castelan, 2000; Marañon, 2002; Wester *et al.,* 2009a). On the other hand, the State of Guanajuato created opportunities for surface and groundwater users to participate in water management activities to regulate water use, preserve their aquifer and use water resources efficiently (Castelan, 2000; Marañon, 2002; Sandoval, 2004: Wester *et al.*, 2009a). Scott and Banes (2008), and Wester, Mollard, Silva-Ochoa, and Vargas-Velazquez (2009b) describe COTAS as playing a nascent role in the basin council and having a minimal impact in reducing groundwater extractions.

Table 3.1: COTAS in the Lerma Chapala Basin (2013)

No.	Name	State	Date of establishment
1	COTAS Celaya	Guanajuato	November 28, 1997
2	COTAS Laguna Seca		November 28, 1997
3	COTAS León		October 1st 1999
4	COTAS Silao-Romita		October 1st 1999
5	COTAS Irapuato-Valle de Santiago		November 6, 1998
6	COTAS Pénjamo-Abasolo		November 6, 1998
7	COTAS Salvatierra-La Cuevita		January 7, 1999
8	COTAS Río Turbio		June 1st, 1999
9	COTAS Acámbaro-Cuitzeo		August 24, 1999
10	COTAS Moroleón-Ciénega Prieta		August 31, 1999
11	COTAS Río Laja		October 1st 1999
12	COTAS Valle de Querétaro	Queretaro	February 20, 1998
13	COTAS Amazcala		September 25, 1998
14	COTAS Huimilpan		December 10, 1998
15	COTAS Valle de Toluca	State of Mexico	July 30, 2003

Source: CONAGUA, 2014.

3.9 The Water User Representative Assembly: the election of water user representatives

Because stakeholder engagement in a water governance process is described in the literature as representative participation, it is important to explain the election process in the LChBC. According to the Organization and Operation Rules, the election of water user representatives occurs in the Water User Representative Assembly, which is part of the structure of the LChBC (see Figure 3.10 for the full structure). This forum is where water users (at the regional, sub-regional, state and/or aquifer level) come together to elect their representatives to the RBC's Board of Governors (articles 5 and 48 - BCOOR). But, the rules lack clarity and do not do not explicitly tease out how individuals are appointed to the assembly of representatives or explain their respective responsibilities. They also fail to specify how to incorporate the RBC's Auxiliary Organizations (Figure 3.8) in to the election process. The assembly is also supposed to enable water users come together to be informed about topics discussed in the basin council, and/or to present their views on topics discussed in the RBC (Article 49 - BCOOR). Figure 3.10 outlines the structure of the Assembly.

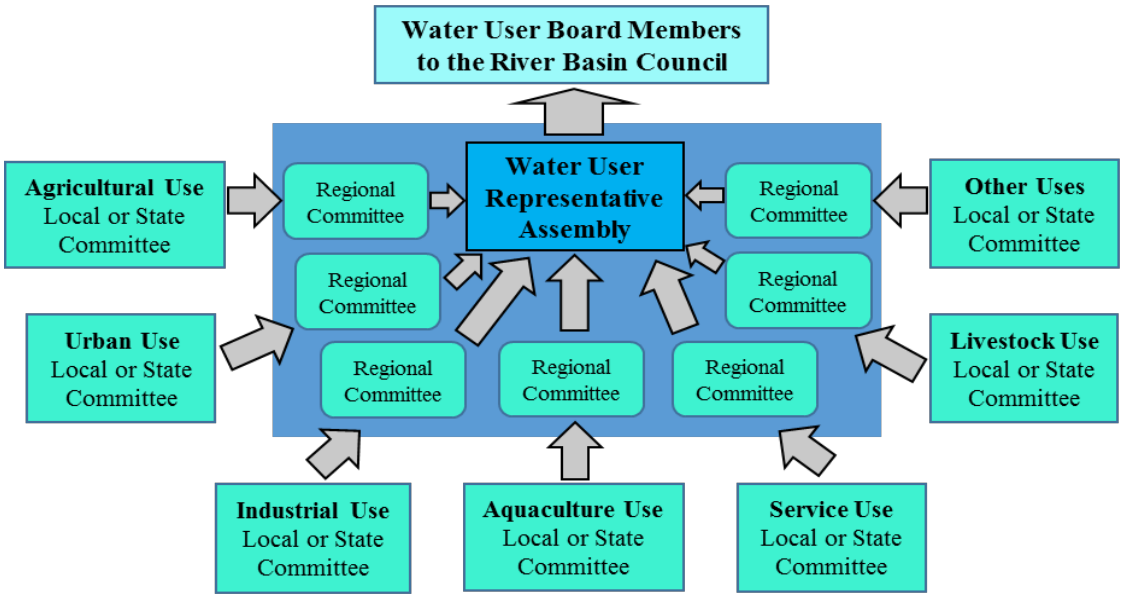


Figure 3.10: Water User Representative Assembly

3.10 Conclusion

As demonstrated in this section of the thesis, water governance in the LChB is highly complex. There are multiple stakeholders involved at multiple scales, attempting to address multiple problems while defending their rights and interests in water resources. These complexities have together resulted in an abstraction of common problems and solutions. There are technical plans and programs in place, as well as laws, policies and institutional structures to address water management problems in the basin, however, these policies are not always reflected in practice. Technical and legal solutions are important, but it is also essential to consider social components in water governance. For example, shifts in water management paradigms may encounter formal and informal structures that support or constrain the implementation of a viable water governance system. It is important to assess how the water governance system reacts to this type of changes. To address these complexities, the assessment framework proposed in this thesis is used to assess the formal and informal aspects of water governance in the LChB. It is anticipated that this water governance assessment framework would provide opportunities for monitoring progress and identifying opportunities to improve the state of water governance. Consequently, this could help enhance the effectiveness of the IWRM process in the LChB.

Chapter Four

4 Methodology

4.1 Research procedure

This chapter discusses the data sources and analytical procedures that were used in the current study. The research started by creating a refined water governance assessment criteria. This was achieved by consolidating disparate water governance principles in the literature into five meta-principles (see Chapter 2). These principles were then used to conduct a content analysis of relevant water policy documents with the aim of assessing the nature and extent to which the Mexican government employed key water governance principles between 1972 and 2008. Finally, the LChB was used as case study to determine the degree to which water governance principles laid out in various policies and plans have been successfully implemented on the ground. Three data sources used in this study included water policy documents and interviews with diverse stakeholders in the LChB. The next section details the content analysis protocol and the utilization of NVivo software for the analysis.

4.2 Content analysis protocol

Content analysis was used in the analysis of documents and interviews because it allows for effective data reduction through well-structured and consistent coding of multiple themes into fewer content categories (Holsti, 1969; Weber, 1990; Graneheim & Lundman, 2004; Hsieh & Shannon, 2005; Bryman, Bell & Teevan, 2012; Krippendorff, 2013). This was particularly useful because of the vast amounts of data analysed (i.e., 18 official water documents and 51 interviews). As well, it made it possible to compare the discussion of various water governance themes in the documents and interviews. The textual data included three water laws and six water policy documents enacted between 1972 and 2008. Further detail on textual data is provided in Section 4.4.1. Interviewees include individuals from agencies at all levels of government directly and indirectly involved in the LChBC as well as water user representatives to the basin council. Finally, it was deemed important to include voices from three federal ministry's headquarters in the sample because of Mexico's centralized approach to water management before 1992.

The study of water governance is complex and multifaceted, involving the perspective of multiple stakeholders with varying interests. Hence, similar to the current

study, multiple researchers (Drieschova *et al*., 2008; Pahl-Wostl *et al*., 2008; Atuyambe *et al*., 2011; Dewulf *et al*., 2011; Farrelly & Brown, 2011; Knüppe, 2011; Khalid *et al*., 2012; Lukasiewicz *et al*., 2013; Tambudzai *et al*., 2013; Gillet *et al*., 2014; Gruszczynski & Michaels, 2014; Nerkar *et al*., 2016; Vedachalam *et al*., 2016) have applied the methodology to gain a coherent understanding of water governance in different contexts. An additional benefit of the methodology lies in its ability to help researchers gain valid, reliable and replicable insights (Holsti, 1969; Weber, 1990; Krippendorff, 2013).

Content analysis pays attention to two major clusters of text: (1) manifest content, which refers to the visible characteristics of texts (e.g., word frequencies, paragraph lengths) and (2) latent content, which refers to the contextual meaning embedded in texts (Krippendorff, 2013). This study is based on the notion that *manifest* and *latent* contents are part of a continuum that work together to construct meanings (Holsti, 1969; Weber, 1990; Gray, & Densten, 1998; Berg, 2001; Sandelowski, 2001; Zhang & Wildemuth, 2009; Krippendorff, 2013). Consequently, both characteristics of the texts were analyzed. Specifically, the latent content analysis was used to interpret the meanings behind texts, for example, the context within which various water governance themes were discussed in the documents and interviews. The manifest content analysis on the other hand involved an assessment of the physical features of the text to understand variations in the level of attention given to various water governance principles within documents and interviews (e.g., the prominence of different themes that were discussed in documents). The analysis of both manifest and latent content made it possible to assess the existence of various water governance principles (i.e., within policy documents), and understand how these principles played out on the ground through testimonies of 51 key informants.

As has been acknowledged by many previous researchers, counting remains a very controversial topic in qualitative research (Giacomini *et al.*, 2000; Hannah & Lautsch, 2011; Kuhn, 2012). Nonetheless, counting qualitative data is generally viewed as useful for identifying important patterns in the data (Hsieh & Shannon, 2005). In the words of Seale and Kelly (2004:317), “counting in qualitative research can help in reassuring the reader that the researcher has not simply trawled through a mass of data and selected anecdotes to report that support his or her particular bias”. In the case of this thesis, it was important to compare dominant perspectives among diverse water stakeholders to those contained in

policies and other official documents. Hence, the number of instances in which various issues recurred in documents and interviews were registered to help record and visualize these trends, consequently making it possible to tease out disconnects among stakeholders and their experiences with prevailing policy conditions.

All the data were imported into a qualitative data analysis software suit (NVivo 9) for analysis. Miles and Huberman (1994) define codes as labels to assign meaning to clusters of information of different sizes (i.e., phrases, sentences or paragraphs), which are used to organize, retrieve, categorize, and draw conclusions from the data. As such, the data was coded under the five principles. The use of NVivo facilitated "solid analytical observations and kept a clear trail of the data and the outcomes" (Chow, 2016:3); hence, enhanced the overall reliability of the analysis. The consistency of the coding structure within the software also made it possible to compare key emergent themes within and between documents and interviews (see QSR International, 2010). To enhance reliability, the codebook was discussed and refined with a fellow PhD student to ensure clarity. Satisfying the content analysis requirement of replicability requires an in-depth documentation of the data analysis procedures (Krippendorff, 2013). Hence, details of the analytical protocols that were used for policy documents and interviews are presented in the next section.

4.3 Analytical structure

The water governance framework developed in the study was used as the analytical structure for both documents and interviews. The purpose of the analysis was twofold: (1) to assess the implementation of various water governance principles in the LChB through the application of the developed framework (see Chapter 2 for framework); and (2) to test the efficacy of the developed framework. Figure 4.1 provides a conceptual summary of the protocol that guided the coding process. It highlights the main data sources, the structure of the data analysis (coding) and the outcomes that were derived from the analysis. Content analysis requires that an analytical codebook be formulated to guide the analysis. The codebook provides rules which govern what and how data is coded (see Appendix III).

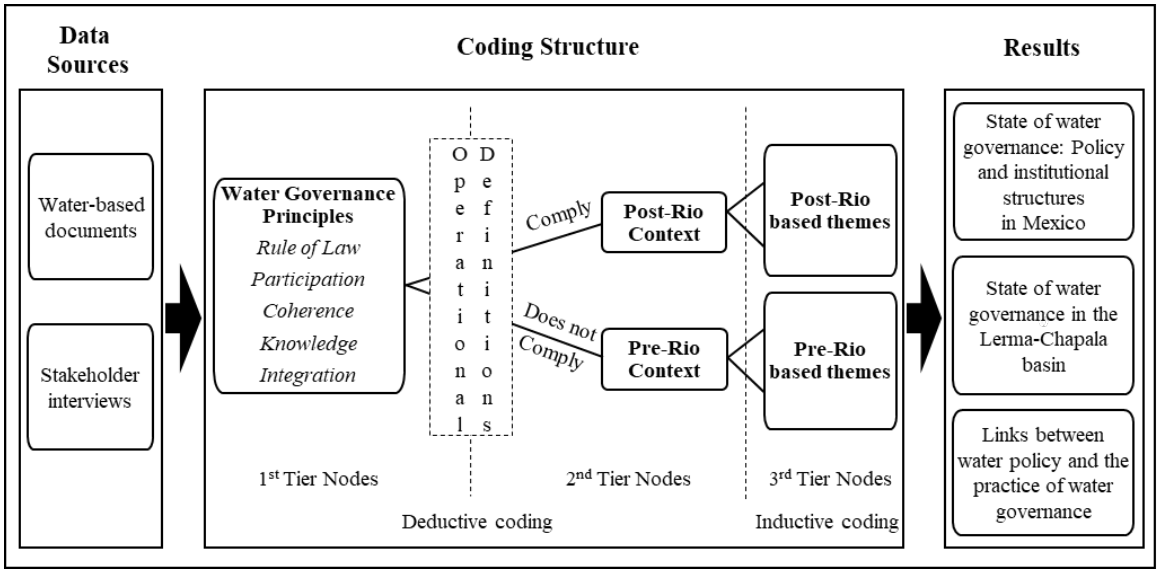


Figure 4.1: Thematic structure for coding documents and interviews

A summary of the coding protocol is provided in Figure 4.1. For parcels of documents and interviews to be coded, they had to adhere to one of the five water governance principles (i.e., *Rule of law, Participation, Coherence, Knowledge,* and *Integration*) in a *pre-Rio* or a *post-Rio* context. Principles were considered as *pre-Rio context* if they adhered to a technocratic state-oriented top-down approach, while they were considered as occurring in a *post-Rio context* if they adhered to a more flexible multi-stakeholder approach. These aforementioned thematic structures were applied in a deductive coding process, since they had strict definitions outlined in Chapter 2. However, matches between data and definitions did not have to be literal to be coded. In the context of participation for example, *post-Rio* based occurrences included themes such as participation in multilateral decision-making forums, and multiple stakeholder engagement among others. The inductive coding process therefore resulted in the emergence of a broad range of themes under each water governance principle. Finally, the inductive codes were reduced into a few and more comprehensive categories through a code revising process which ensured that similar themes were lumped further together (Miles & Huberman, 1994); hence, making the process of summarizing the results more effectively.

4.4 Data sources

The data for the case study of water governance in the LChB came from various sources. The Technical Committee of the Global Water Partnership suggests that when analysing water governance systems, it is important to understand its three primary

functions: *constitutional, organizational* and *operational* (Rogers & Hall, 2003). These primary functions cover diverse issues that include but are not limited to policy, legislation, institutional and organizational structures, and implementation mechanisms and processes for water development and management. These functions have also been discussed in the institutional arrangements literature (Mitchell, 1975, 1989; Watson *et al*., 1996; Young, 2002; Lamoree & Harlin, 2002).

Constitutional (regulatory) functions create an enabling environment within which the other two functions can operate, by developing policies, laws, norms and regulations, and disclosing them publicly; thus, establishing clear goals and rules that safeguard against arbitrary governance. It includes both statutory (formal) and customary (informal) laws that legitimize exercising authority according to established procedures (after Mitchell, 1975, 1989; Watson *et al.,* 1996; Young, 2002; Rogers & Hall, 2003; WWAP, 2003).

Organizational (actor/stakeholder) functions establish clear demarcation of responsibilities. These include checks and balances, and the division of power through clearly established roles that separate administration, regulation, enforcement and service provision functions, filling jurisdictional gaps and eliminating overlaps, and matching responsibilities to authority and to capacities for action (after Mitchell, 1975, 1989; Watson *et al.,* 1996; Young, 2002; Rogers & Hall, 2003; WWAP, 2003).

Operational (implementation) functions pertain to processes used to carry out water management activities efficiently. It includes practical water management instruments such as information dissemination and awareness campaigns, but also those that fulfill specific needs such as service provision, enforcement, monitoring, data collection, and other activities established by the constitutional and organizational functions (after Mitchell, 1975, 1989; Watson *et al.,* 1996; Young, 2002; Rogers & Hall, 2003; WWAP, 2003).

Data sources were selected for the current study with these functions in mind. Water laws and policies, as well as institutional structure documents for the water sector are used in this dissertation for the collection of data concerning the *constitutional* and *organizational* functions of water governance. Face-to-face semi-structured interviews with key informants provided data pertaining to the implementation of the *operational functions*. It is important to note that research was conducted in series, and interview guides

were developed based on themes that emerged from document analysis. The next sections detail the nature of these data sources, their retrieval, and analysis protocols.

4.4.1 Document data and analysis

The specific documents which were analysed were grouped into three sets: (1) water laws, (2) Internal Regulations[13] (institutional structures), and (3) water policy documents[14]. These document groupings made it possible to compare water governance principles among documents and understand major landmark events in the evolution of water governance in Mexico. Documents published between 1972 and the year of the study (2008) were retrieved and used in the analysis. This represented a total of 18 documents spanning 2,011 pages. A summary of all the documents which were analysed is provided in Table 4.1.

Water policy documents are the cornerstone of water resource planning in Mexico; consequently, all accessible water policy documents at the time of the research were included in the sample in order to analyse the evolution of water management narratives in Mexico. The 1972 Federal Water Law (FWL) was the earliest accessible document at the time of research, and is the law that preceded the shift from a *pre-Rio* to a *post-Rio* approach to water management.

[13] Internal Regulations documents (Reglamento Interno) are published in the Official Daily Paper of the Federation (Diario Oficial de la Federación) where the official structure of an institution is made public. This documents also outline the duties and responsibilities of all major areas within the agency. From here onwards will be referred to as "institutional structure documents".

[14] There is no consistency for naming these documents, because the different presidential administrations change the name from "National Hydraulic Plan" to "National Hydraulic Program" or simply "Hydraulic Program." For that reason all these documents are referred to as "water policy documents".

Table 4.1: List of official documents analyzed

Type of document	Governance Function	Paradigm Shift (1992)	Title	Number of Pages	
				Original Document	Text Only*
Legislation	Constitutional	Before	Federal Water Law (1972)	29	44
		After	National Water Law (1992)	23	49
			National Water Law (2004 Reforms)	69	122
Policy		Before	National Hydraulic Plan 1975	582	244
			National Hydraulic Plan 1981	139	82
			National Water Program 1984	256	103
		After	Hydraulic Program 1995-2000	54	69
			National Hydraulic Program 2001-2006	128	165
			National Hydraulic Program 2007-2012	163	103
Institutional structured documents	Organizational	Before	Ministry of Agriculture and Hydraulic Resources (MAHR), Internal Regulations (1977)	49	22
			Ministry of Human Settlements and Public Works (MHSPW), Internal Regulations (1977)	39	34
			Ministry of Urban Development and Ecology (MUDE), Internal Regulations (1983)	38	24
			Ministry of Agriculture and Hydraulic Resources (MAHR), Internal Regulations (1985)	48	38
			Ministry of Agriculture and Hydraulic Resources (MAHR), Internal Regulations (1989)	38	19
		After	Ministry of Agriculture and Hydraulic Resources (MAHR), Internal Regulations (1993)	43	24
			Ministry of the Environment, Natural Resources and Fisheries (MENRF), Internal Regulations (1996)	48	28
			Ministry of the Environment and Natural Resources (MENR), Internal Regulations (2001)	82	40
			Ministry of the Environment and Natural Resources (MENR), Internal Regulations (2006)	183	83
Total number of pages				**2,011**	**1,293**

* The original documents have different font, size, line spacing, margins, etc.; consequently, for standardization purposes all documents were edited in Word from Microsoft Office 2007 considering only text with Times New Roman 12" font, 1.5 line spacing, Normal Margin, and no spacing between paragraphs. Policy documents and water laws only include text, and for the institutional structure documents, only the administrative and operative areas included in the study were considered.

Both manifest and latent content of the policy documents were analyzed. To enable analysis in NVivo, older documents in hard copy format were digitized, after which all documents were imported into the software for analysis. The analysis involved capturing varying levels of attention given to different aspects of water governance. This helped assess the dominance of *pre-Rio* and *post-Rio contexts* with which the five water governance principles that were developed occurred. The analysis involved reading all documents and coding them under their respective orientations (i.e., *pre-Rio context* or

post-Rio context) and principles (i.e., *Rule of law*, *Participation*, *Coherence*, *Knowledge*, and *Integration*). The analytical structure applied for both text and interview data is summarized in Figure 4.2. It depicts the deductive portion for coding data, which includes first and second tier nodes (see Figure 4.1). After coding all texts under their respective orientations and principles, NVivo automatically generated the percentages of texts in each document that were coded under each of the coding categories. Frequencies and percentages of text coverage are useful for assessing the relative level of attention given to various themes and topics (e.g., see Millar & Budgell, 2008). In the current study, these percentages and frequencies of coverage were used to assess the level of attention given to the five principles in a *pre-* or *post-Rio* contexts.

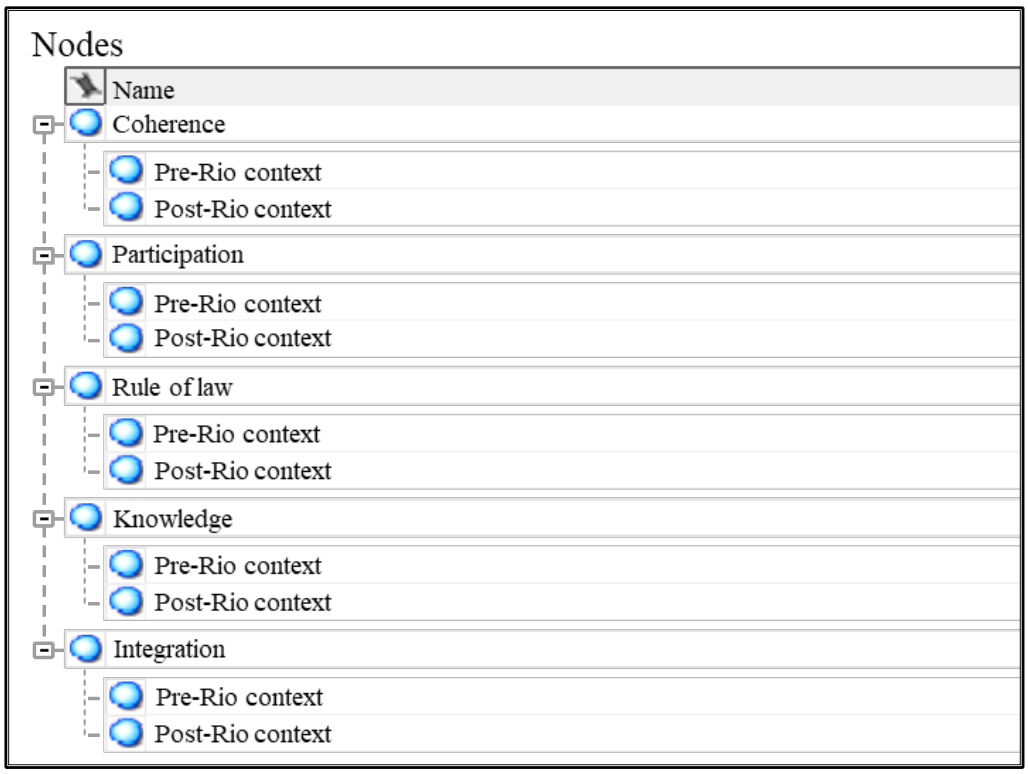


Figure 4.2: Coding structure for documents and interviews

4.4.2 Interview data and analysis

Based on major themes that emerged from document analysis, interview guides were developed, after which interviews were conducted with key local and national stakeholders whose activities pertained to the LChB. This presented an opportunity to assess water governance within the context of the basin and test the water governance assessment framework which was developed in this thesis on the ground. The interview

process also provided insights on the extent to which existing water governances policies were being successfully applied on the ground. Thus, the study was able to identify key policy/practice disconnects.

Out of 58 potential participants who were contacted, a total of 51 key informants participated in interviews, representing a response rate of over 80%. Key informants were selected among government officials, water user representatives within all states in the LChB and federal government representatives from headquarters in Mexico City. Details of these participants are contained in Table 4.2. Semi-structured interviews were used to enable the comparison of perspectives within and across stakeholder groups and provide opportunities for the emergence of individual stories (Schensul *et al.,* 1999).

Table 4.2: Informants from the Lerma-Chapala basin and from federal ministries' headquarters

State	Federal Government	#	State Government	#	Water users	#	Total
• State of Mexico • Queretaro • Guanajuato • Michoacán • Jalisco	• National Water Commission * • Ministry of the Environment and Natural Resources *	10	• State Water Commission • Ministry of Agriculture • Ministry of the Environment and Sustainable Development	15	• Agriculture • Livestock • Industrial • Drinking water and sanitation • Other Services • Aquaculture	23	48
Mexico City (headquarters)	• National Water Commission • Ministry of the Environment and Natural Resources • Ministry of Agriculture, Livestock, Rural Development, Fisheries and Food	3		0		0	3
Total Interviews		**13**		**15**		**23**	**51**

* Local Office of the federal agency in each state in the Lerma-Chapala basin.

The subset of key informants made it possible to capture a wide range of voices which were both directly and indirectly associated to IWRM related activities and the LChBC. Purposive sampling was used to identify key informants engaged in the LChB in different capacities (Patton, 1990; Guarte & Barrios, 2006), which included: (1) federal or state government representative engaged in the Lerma-Chapala Basin Council, (2) water user representatives from all states, and (3) state level liaisons for various institutions indirectly engaged with the Council, for example, ecology and environmental ministries.

Semi-structured interviews were conducted using an interview guide on topics related to the five water governance principles developed in this thesis. Specific topic emerged from the document analysis, and are summarized in ten major thematic areas in Table 4.3. In-depth interviews helped diagnose problems, identify alternatives, and capture stakeholders' suggestions for better water governance in the LChB (Paneque Salgado *et al.*, 2009).

Table 4.3: Interview topics and associated water governance principles

Topics	Associated Principles
(1) The role played by all three levels of government and water users in governance forums and networks.	Coherence, Rule of law
(2) The type of issues and concerns brought forward and discussed within the LChBC.	Participation, Knowledge
(3) Stakeholders' role the LChBC, their engagement in decision making, and in the execution of agreements.	Participation, Coherence
(4) The role of the LChBC in the application of an integrated water resources management process.	Integration, Participation, Coherence
(5) The degree of cooperation and coordination among institutions, organizations and water users in the implementation of policies, plans and programs.	Coherence, Integration
(6) The capacities of the LChBC and of its members (where applicable) with regards to human resources, professional profiles, equipment, funding, training, and information flow and availability.	Coherence, Knowledge
(7) Limitations and opportunities to establish an effective water governance system in the LChB	All five principles
(8) Changes they would like to see to improve water governance systems in the LChBC.	All five principles

Face-to-face interviews were conducted between July and October of 2008. While the shortest interview lasted 32 minutes, the longest interview lasted 3 hours and 19 minutes. The average duration of each interview was 99 minutes. All interviews were recorded in digital format. Interviews were imported into NVivo 9 for analysis in audio format. NVivo 9 allows the researcher to code audio files be capturing and saving key parcels of the files. The software also documents the 'time span' for each and all coded excerpts and provides a column for transcribing or making notes that pertain to the coded parcels of audio. A major advantage of audio coding and analysis is that it keeps the researcher close to the original data, as it preserves features that are lost in transcription (i.e., tone of voice, silences, utterances, intonation, shifts in emphasis, levels of interests), hence helping the researcher contextualize the data more clearly (Gibson *et al.*, 2005; Wainwright & Russell, 2010). Since interviews were conducted in Spanish and the research

was produced in English, only audio aspects of the interview that were coded and transcribed were translated. Language translation aspects are further addressed in Section 4.5. Similar to the document analysis, the interviews were coded based on the content analysis structure provided in Figure 4.1.

After interviews were coded under the principles (i.e., *Rule of law, Participation, Coherence, Knowledge* and *Integration*) and contexts (i.e., *pre-Rio* / *post-Rio*) they reflected that interviewees often focused on certain dominant principles even when questions concerned other principles. For example, issues around water pollution or the allocation of water resources, water users tend to complain about a feeble participatory water governance structure and the failure of their representatives to defend their interests. To get a sense of the major issues of concern to interviewees, the number of instances in which various principles were repeated (in the *pre-Rio* and *post-Rio* contexts) were quantified. Bernard (2003:101) contends that "looking for repetitions and similarities" within qualitative data constitutes a useful way of discovering dominant themes. In the case of this study, repetitions were used to identify commonly recurring themes, under the five principles and contexts that were discussed by interviewees as having implications for water governance.

The final analysis that was conducted in the study involved comparing outcomes from the interviews to the contents of the official documents that were enforced at the time of the study. These documents included the 2004 National Water Law, the 2006 Internal Regulations of the Ministry of the Environment and Natural Resources, and the 2007-2012 National Hydraulic Program. The purpose of this comparison was to assess the extent to which existing policies were being implemented in practice. This analysis also provided insights on various constraints and achievements in water governance within the LChB.

By applying the same codebook to the interviews and documents, it was possible to identify similarities and differences between both data sources though content analysis. This comparison made it possible to compare theory (i.e., water governance policies) to practice (i.e., the state of water governance as experienced by stakeholder on the ground).

All documents and interviews that were used for this study were obtained in Spanish. The researcher conducted the analysis in Spanish for as long as possible because original narratives could be altered and even lost in translation. The decision to conduct the

analysis in Spanish was also motivated by time constraints. For example, documents spanned over 2,000 pages, while total length of interviews was over 80 hours long. It was therefore not time efficient to translate these contents to English prior to analysis. Since the thesis was written in English, only direct quotes which were drawn from interviews and documents were translated. This is in agreement with Van Nes, Abma, Jonsson and Deeg (2010) who recommend that researchers remain in the original language for as long and as much as possible in order to avoid potential limitations such as loosing meanings in the analysis.

Chapter Five

5 Results and Analysis

This chapter focuses on reporting quantitative trends that emerged from the data analysis that was conducted to account for dominant themes within documents and interviews. This serves as a first step to understanding the aspects of water governance that were most prominent within Mexico's water policy documents and the interviews that were conducted with stakeholders in the Lerma-Chapala basin. Because wide range of themes that emerged under the five proposed water governance principles, the quantification of emerging themes within interviews and policy documents made it possible to tease out dominant commonalities and differences. In addition to discussing these trends, the current chapter provides brief highlights of the key contexts within which various themes were discussed. Chapter 6 provides more depth by focusing on the nature and characteristics of the issues that emerged in the document analysis and interviews, after which documents and interviews are compared to understand the extent to which water governance policies translate into practice.

This chapter is divided into three major sections. The first section presents descriptive trends of the amount of coverage that was given to various principles within policy documents (N=18), after which it briefly discusses the context of these themes. The second section provides trends on the frequency with which various themes emerged in the interviews (N=51) and briefly highlights key aspects of these themes. The third section compares the two aforementioned sets of results to understand the extent to which various water related polices are reflected in practice. In terms of the results presented here, the *pre-Rio* and *post-Rio* contexts are used to denote compliance and non-compliance to the five proposed water governance principles (i.e., *Participation, Coherence, Rule of law, Knowledge*, *Integration*) respectively.

5.1 Longitudinal study: patterns in the occurrence of water governance principles in official documents through time (1972-1992 and 1993-2008)

The results presented in this section were generated by applying the proposed water governance assessment framework in a content analysis of the official documents. Eighteen documents which were used for the analysis were grouped into three sets based on their orientation (i.e., type, purpose and format) of their content: (a) water laws, (b) institutional

structure documents, and (c) water policy documents. These groupings made it possible to compare water governance principles among documents and trace the temporal evolution of water governance in Mexico. Figure 5.1 presents relative percentages of text coverage in a *pre-Rio context* (below the axis), and the *post-Rio context* (above the axis) within each three types of documents. The vertical dashed line in the middle indicates the shift in water management paradigms, which occurred in 1992. Based on Mexico's traditionally authoritarian approach to water management, I hypothesize that topics associated with the *pre-Rio context* will be predominant before 1992 relative to the presence of topics pertaining to the *post-Rio context*. *Post-Rio context* elements are expected to increase through time, especially after 1992, while *pre-Rio context* themes are expected to decrease after 1992.

Results illustrate the context in which Mexico's water management governing systems have transitioned between 1972 and 2008. Findings in Figure 5.1, show that, to various degrees, all five water governance principles are present in almost all official documents both in a *pre-Rio* and *post-Rio* contexts through the entire period (see Appendix V). *Participation* is the only principle missing in four institutional structure documents. Findings also show that before 1996 there were no provisions made within institutional structures to ensure that the participation of water users was implemented on the ground. In compliance with the definition provided for the *Participation* principle in this study, the 1992 National Water Law makes reference to promoting *inclusive stakeholder participation in water related decision making*, as demonstrated by Article 14 as follows:

> The [National Water] Commission will accredit, promote and support the organization of [water] users to improve water resource use and the preservation and control of its quality, and to encourage the participation of water users at state, regional or basin levels, under the terms of this law and its regulations (DOF, 1992)

Therefore, findings suggests a failure by the federal government to build a foundation for inclusive water user participation between October 1993[15] and July 1996[16]. This finding also suggest that changes in the structure of the NWC took place after the financial crisis of 1994, when the Mexican State had to comply with the 'good governance' and IWRM

[15] After the enactment of the 1992 National Water Law, the Internal Regulations of the Ministry of Agriculture and Hydraulic Resources were first amended on October 29, 1993.

[16] The National Water Commission was transferred from MAHR to the newly created Ministry of the Environment, Natural Resources and Fisheries on December 1994, but the structure of the MENRF was not published until July 8, 1996.

requirements imposed by the IMF and the World Bank, to qualify for funds. Thus, the first evidence of an institutional structure for facilitating this engagement occurred with the creation of the 'Unit for Rural Programs and Public Participation' (URPPP) in 1996. This area within the NWC was responsible for organizing water users and ensuring their participation in water related decision (SEMARNAP, 1996a). The Coordination of River Basin Councils (CRBCs) was then established in 1997 as an area subordinate to URPPP. The actions of the URPPP within the structure of the NWC comply with the definition of *Participation*, since this area became responsible for promoting *inclusive stakeholder participation in water related decision making*. This convergence between text and the definitions for the five principles proposed in this thesis is demonstrated in Figure 5.1.b, since the creation of URPPP is registered in the results for the 1996 MENRF institutional structure under *Participation* in a *post-Rio context* (Appendix V, Table 3).

Torregosa (2004) confirms this major change in the structure of the NWC with the creation of the CRBCs, which was to support the development of RBCs and strengthen them. This new structure that supports water user participation, marked a change in pace in the consolidation of RBCs in Mexico. Ripples of this new structure that have been acknowledged in the literature include the promotion of water user organizations in 1997 (Castelán, 2001a) and the creation of three COTAS in the LChB in 1998 (Guerrero Reynoso, 2000) (see Section 3.8). Furthermore, Article 15 of the mandatory Regulations of the National Water Law (RNWL) was amended in 1997, allowing water users to participate in equal numbers as government representatives in the LChBC, and in other RBCs (DOF, 1997). Finally, before the creation of CRBCs in 1997, only two RBCs had been created in Mexico (i.e., the LChBC in 1993, and the Valley of Mexico Basin Council in 1995), which is a sharp contrast to the twenty three RBCs which were established between December 1998 and September 2000 (CONAGUA, 2011)[17]. These changes demonstrate Mexico's commitment to transition from a traditional state-centred top-down model to a more inclusive water governance-based approach.

[17] The last RBC (Central Pacific Coast) was installed on February 25, 2009 (CONAGUA, 2011).

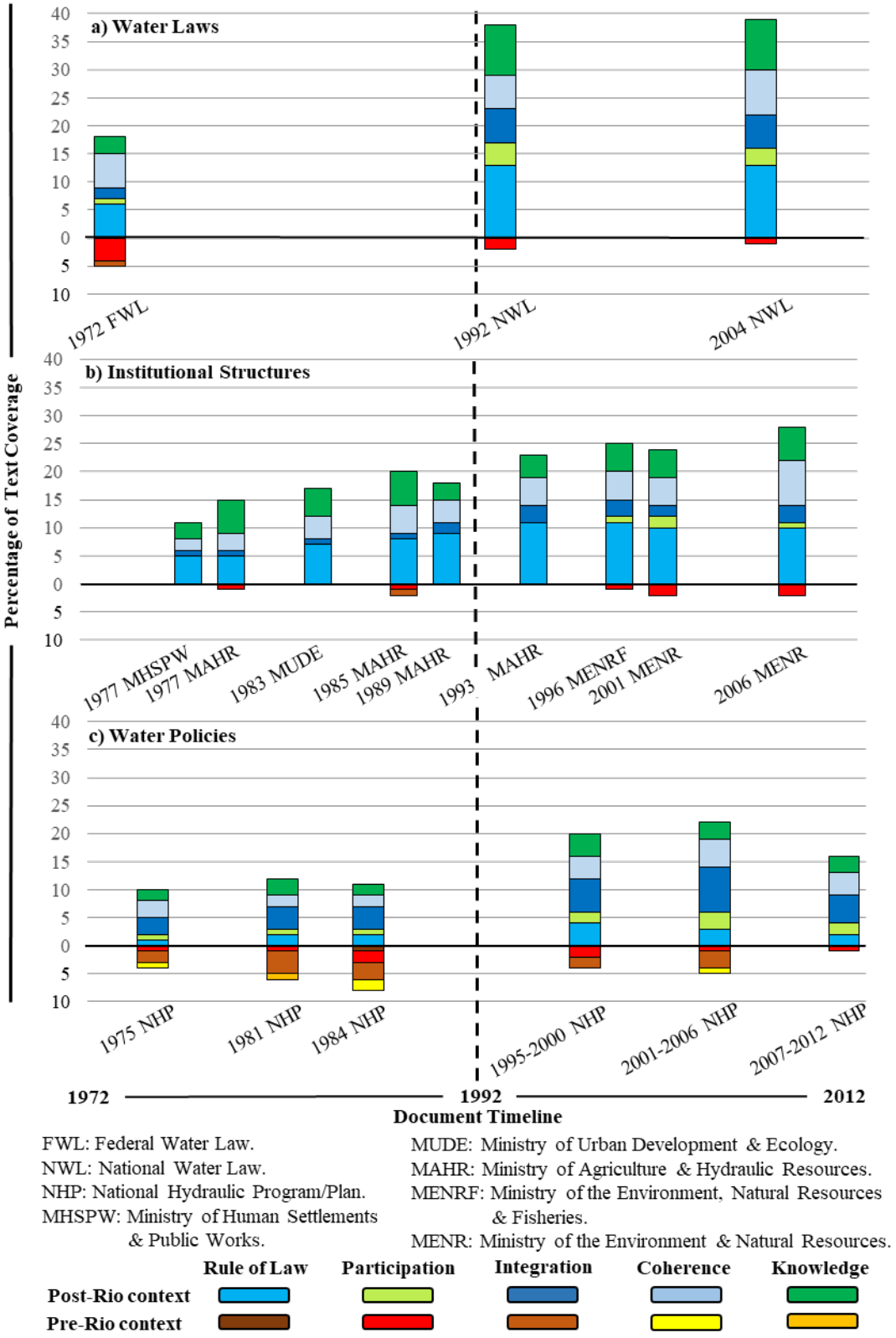


Figure 5.1: Timeline of the Transition in Water Governance Principles in Official Documents

The frequency with which the three types of documents mentioned themes related to the different water governance principles show that on average, all five principles were discussed predominantly in a *post-Rio contexts*. These findings were surprising because of the traditionally sectoral, centralized and authoritarian (*pre-Rio*) approach to water management in Mexico. Results also reveal that all three types of documents exhibit an increasing pattern of occurrences in a *post-Rio contexts*, which was an expected pattern. The lowest levels of these occurrences were registered during the 1970s, while the highest levels occurring in the first decade of the 21st century. However, unexpectedly, the 2007-2012 NHP showed a decrease in the prominence of water governance themes. When reviewing this document, an increase in topics associated with climate change (when compared with previous policy documents) was noticed. This increase in the discussion on climate change could explain the drop in the percentage of text coverage associated with water governance themes, since climate change was at the forefront of policy and planning during this period. However, the topic of climate change is not a major focus of this thesis.

The outcomes of the content analysis indeed reveal that in theory, drastic changes occurred in various water-related documents between 1972 and 2008, evident in the increase adoption of water governance principles that were geared towards creating an IWRM process.

As expected, water laws (Figure 5.1a) and water policy documents (Figure 5.1c) display a marked increase in the percentage of text coverage in the context of the five water governance principles after 1992. Unique to institutional structure documents (Figure 5.1b), results showed an unexpected, steady (instead of a noticeable) increase in the amount of text devoted to discussing the five water governance principles in a *post-Rio context* from 1977 to 2006. Nonetheless, the general trend suggests a progressive pattern in the adoption of water governance rhetoric in official documents. Literature indicates that Mexico followed a centralized top-down approach until 1983, when it began transferring authority and responsibility to state and municipal governments (Ingram *et al*., 1995; Rodriguez, 1997; Pineda Pablos, 2004; Castro, 2006; Sanchez Mesa, 2006). Hence, the 'collaboration' of the three levels of government and the 'coordination' of their effort is a theme that became part of the government rhetoric after 1983, as illustrated in the following statement:

> The 1984 National Water Program considers the coordination of the Ministry [of Agriculture and Hydraulic Resources - MAHR] with states and municipalities, because the [present] diversification of projects require the collaboration and participation of state and municipal governments, as well as the intervention of other federal institutions whose roles are related to projects associated with improving the use of water resources (SARH, 1984:189).

After 1992, results show an increase in the discussion of themes associated with the five water governance principles proposed in this thesis, as illustrated by the increase in the percentage of text coverage in a *post-Rio context* (Figure 5.1). For example, the previous quote only includes 'collaboration and coordination' activities among government agencies at all levels, but after 1992 themes like 'collaboration and coordination' expanded to include the activities of water users and other stakeholders, suggesting compliance to the *participation* principle. This is captured in the following quote:

> Article 5: For the implementation and application of the National Water Law, the Federal Government will promote the coordination of activities with state and municipal governments, without infringing their authority and within the range of their respective responsibilities, and will encourage the participation of water users and private individuals in the development and management of hydraulic public works and services" (DOF, 1992).

This quote also provides evidence that demonstrates the utility of the water governance principles proposed in this thesis, and their occurrence in official texts. For example, Article 5 of the 1992 NWL (quoted above) makes reference to the Federal Government promoting the coordination of activities with various stakeholders in the development and management of water services. This example aligns with the *Coherence* principle which implies the *facilitation of well-coordinated actions and stakeholder collaborations at all scales.* Furthermore, Article 5 makes reference to the participation of multiple stakeholders (i.e., governments at federal, state, and municipal levels, as well as water users and private individuals) in the development and management of water resources, which complies with the definition of *Participation* which involves *inclusive multi-stakeholder engagement in water related decision making*. These evidence, in part, demonstrates the usefulness of the proposed framework as an assessment tool.

Emerging trends in the three types of documents together suggest that, by 2008, Mexico had likely established an enabling environment that could have allowed for the implementation of a viable water governance system. Several authors have noted that IWRM was embraced in Mexican water policy in 1992 (González-Villarreal & Garduño,

1994; Mestre, 1997, 2001; Castelán, 2001; Dourojeanni, 2001; Pérez Prado, 2003; Wester *et al.*, 2003; Castro, 2006), which from the perspective of the present study, explains the increase in the usage of water governance terminology in official water documents.

The percentage of text coverage pertaining to the five water governance principles in a *pre-Rio context* varied across the three sets of documents. This was expected, because differences on the orientation (i.e., type, purpose and format) of each document. Water laws are the only group of documents that show a decreasing trend of occurrence with the highest levels registered in the 1970s, and the lowest values appearing in the first decade of the 21st century. However, institutional structure documents and water policies do not follow a clear increasing or decreasing patterns in the usage of *pre-Rio* terminology. This trend was to an extent expected, since the literature indicates that Mexico was transitioning from a centralized state-centred top-down approach to water management associated with the pre-1992 period to a more flexible multilevel and multi-stakeholder approach implied in the concept of water governance after 1992. Hence, official documents prior to 1992 contain control-command characteristics, as well as strategies involving a regional development approach, with sectoral and economic tendencies, and supply management inclinations (Table 1.1), which are characteristic of the water management strategy applied in Mexico before 1992. This strategies are illustrated in the following quote from the 1981 National Hydraulic Program:

> Water has been a key factor in Mexico's economic development and will continue to play a vital role supporting economic activities and improving the lives of the population, which are also objectives established in the [National] Global Development Plan. The quantification of water demand at national and regional levels is based, on the one hand, on the evolution of water use and on technical projects on coefficients of water use volumes, and on the other, on the goals established in the [National] Global Development Plan and in sectoral plans and programs, such as the Mexican Food System, the National Agricultural and Forestry Program, the National Urban Development Plan, the National Industrial Development Plan, the National Energy Plan, and the National Plan for the Development of Fisheries (SARH, 1983:44).

The strategies cited in this passage do not comply with the operational definitions provided for several water governance principles proposed in the present study. For example, these strategies mentioned suggest a fractured and sectoral approach (captured in a *pre-Rio context*) to water management, that do not comply with the ideals of facilitating *well-coordinated actions and stakeholder collaboration and all scales* captured under the definition of *Coherence* provided in this dissertation. Furthermore, this passage does not

comply (in a *pre-Rio context*) with the definition of *Integration,* since it does not demonstrate the application of *an intersectoral approach that uses the basin as the planning and management unit.* Additionally, it does not appear to be *rooted in local context,* and does not seem to be effective for promoting the *long-term sustainability of water resources.* This disparity between the operational definitions provided for the water governance principles provides further evidence of the usefulness of the assessment framework proposed in this research.

As Mestre (2001), has explained Mexico's approach to water management after 1992 shifted towards the sustainable management of water resources, thus considering equally the economic, social and environmental elements of development, thus replacing the traditional focus on economic development. Among other changes, he suggests that Mexico adopted a demand management approach to water management, which replaced the traditional supply management approach.

The analysis also reveals that the adoption of different water management paradigms were not absolute. For example, there were transitional periods where old and the new water management paradigms overlapped within the documents; hence, some characteristics of the old traditional ways can be observed after the adoption of new policies. This was especially evident in the existence of texts in a *pre-Rio context* within post-1992 documents. It is also worth noting the *pre-Rio context* was generally lower in prominence across all document types prior to 1992, something that was not expected. However, in general terms their percentage of text coverage tend to decrease after 1992. Thus, these findings are here interpreted as not contradicting the idea that, in theory, progress has been achieved in the adoption of water governance principles in Mexico. Nonetheless, it suggests that some authoritarian elements from the pre-1992 time period likely persist amidst the adoption of a water governance-based approach after 1992. For example, the exclusion of water users in decision making was implied in some post-1992 texts such as the 1995-2000 Hydraulic Program which is quoted as follows:

> In [rural] communities [with less than 2,500 inhabitants], the participation of the population in the definition of criteria for the provision of water services has been insufficient, which has resulted on poor decisions being made because these do not take into account local conditions. In addition, there has been inadequate infrastructural maintenance, and there is unfinished works due to lack of funds or because of bad programming or poor project design (SEMARNAP, 1996: 22).

This quote from 1996 states that little public participation (if any) was taking place in rural communities, pertaining planning, development and management of water service utilities. It also discloses that government officials were making decisions with information that did not consider the local context. The text suggests that mistakes were made resulting in bad programming and/or poor project design, and that the mismanagement of financial resources and poor planning may have resulted in unfinished water infrastructure projects. This consequently impacted some rural communities that continued with inadequate water services and infrastructure.

In summary, this section partly addressed the second objective of the thesis, which is to apply the developed water governance assessment framework to official water policy documents with the aim of understanding *pre-* / *post-Rio* water governance transitions in Mexico. Findings show a significant increase in the usage of *post-Rio* water governance terminology after 1992. They also point to a decrease in the percentage of text coverage of terminology associated with a *pre-Rio context* since 1992. Consequently, results reveal policy shifts in water management paradigms in Mexico after 1992 from a *pre-Rio* to a *post-Rio* practice.

The application of content analysis with the conceptual framework resulted in the emergence of a broad range of context-based themes pertaining to water governance. These themes were then reduced into more comprehensive and coherent themes (Table 5.1) using a code revising process (see Miles & Huberman, 1994). In effect, the framework and methodology helped conceptualize over three decades of policy and planning for water resources in the Mexican context, since the official documents reviewed span over thirty years (1972-2008). For example, *collaboration and coordination* is a theme that emerged from the document data through inductive coding (Table 5.1), and is encapsulated within the operational definition of the *Coherence* principle provided in this thesis, in the sense that institutions and organizations should mobilize their efforts in ways that facilitate *well-coordinated actions and stakeholder collaborations at all scales in order to deliver what is needs when and where it is needed, while making the best use of available resources*. Also, from a historical point of view, *collaboration and coordination* is a theme that appears consistently in all documents. The following quotes from the 1972 Federal Water Law (FWL) and the 2007-2012 National Hydraulic Program, respectively, illustrate how the

themes of *collaboration and coordination* appeared over time in official texts, and provide evidence of the usefulness of the framework proposed in this study:

> ARTICLE 54. The Ministry [of Hydraulic Resources], in coordination with the local authorities, shall develop the necessary [new] towns to compensate for urban property afflicted by the construction of waterworks. In the case of urban or communal lands, the Federal Agrarian Reform Law will be applied in coordination with the Ministry of Agrarian Reform (DOF, 1972).

> Finally, it should be emphasized that in order to fulfill each of the goals in the 2007-2012 National Hydraulic Program, it is essential for the institutions and organizations with stake in the management and preservation of water resources in our country, to coordinate their activities and to collaborate with each other, and with society as a whole (CONAGUA, 2008a:163).

Results from the analysis of official documents show some strengths of the proposed assessment framework. They indicate that there is no clear division in the transition between the old and the new water governance paradigms, in the sense that some of the characteristics of one may also appear in the other. For example, the quote above from the 1972 FWL establishes a coordination that is defined by the authority of each agency or level of government, as the local authority represents the town, the Ministry of Agrarian Reform is who applies the agrarian (and land) reform legislation, and the Ministry of Hydraulic Resources applies the 1972 FWL. However, it is not clear if this type of 'collaboration and coordination' address or not the issue of institutional 'fragmentation and sectorization'. This shows that the proposed framework is able to capture both *pre-Rio* and *post-Rio* characteristics in a water governance system, and identify various constraints, and opportunities for improvement, as it will be discussed further in Chapter 6.

Table 5.1 presents the themes that emerged from a code revising process as they pertain to the five water governance principles. These themes emerged from the application of an inductive coding process to the official documents discussed above, as well as from interviews with key informants, which are discussed in the next section. It is noteworthy that the water governance assessment framework proposed in this thesis is not set in stone. Hence, researchers could continue to build in any themes that do not conform to the definitions of any of the five proposed principles.

Table 5.1: Water governance themes by principle
(from policy documents and interviews)

Water Governance Principle	Post-Rio Context Themes	Pre-Rio Context Themes
Participation	Participation in multilateral decision-making forums	Little participation / governments make decisions
	Multiple stakeholder engagement	Questionable water user's representation
Coherence	Collaboration and coordination	Fragmentation and sectorization
	Decentralization to the lowest viable level	Centralized decision making
	Sufficient operational capacities	Insufficient operational capacities
Rule of Law	Comprehensive rules and regulations	Legislation gaps and overlaps
	Institutional structures for water management	Inadequate institutional structures
	Law enforcement	Little law enforcement
Knowledge	Efficient information systems	Inefficient information systems
	Adequate education	Insufficient education
	Dialogue and negotiation	Lack of transparency
Integration	Basin planning and management	Regional development planning and management
	Sustainability and Conservation	Negative environmental impacts

5.2 Response of participants applying assessment framework to interviews

This section reports results that emerged from interviews conducted with various stakeholders in the LChB during the summer and early fall of 2008. The assessment framework proposed in this thesis is applied here to understand the condition of water governance on the ground. For the analysis, study participants interviewed were grouped into two broad clusters to help identify variations in accounts based on location and stakeholder type. The first grouping was meant to account for spatial variation in stakeholder experiences: hence it was based on the geographical locations of the informant relative to the basin (i.e., upriver and downriver states). Thus, these respondents were grouped by state (Figure 5.2). The second grouping was meant to reflect variations in

perspectives based on the type of stakeholders. It consisted of three categories: (a) water users[18], (b) state officials, and (c) federal officials.

Source: WWAP, 2012:861.

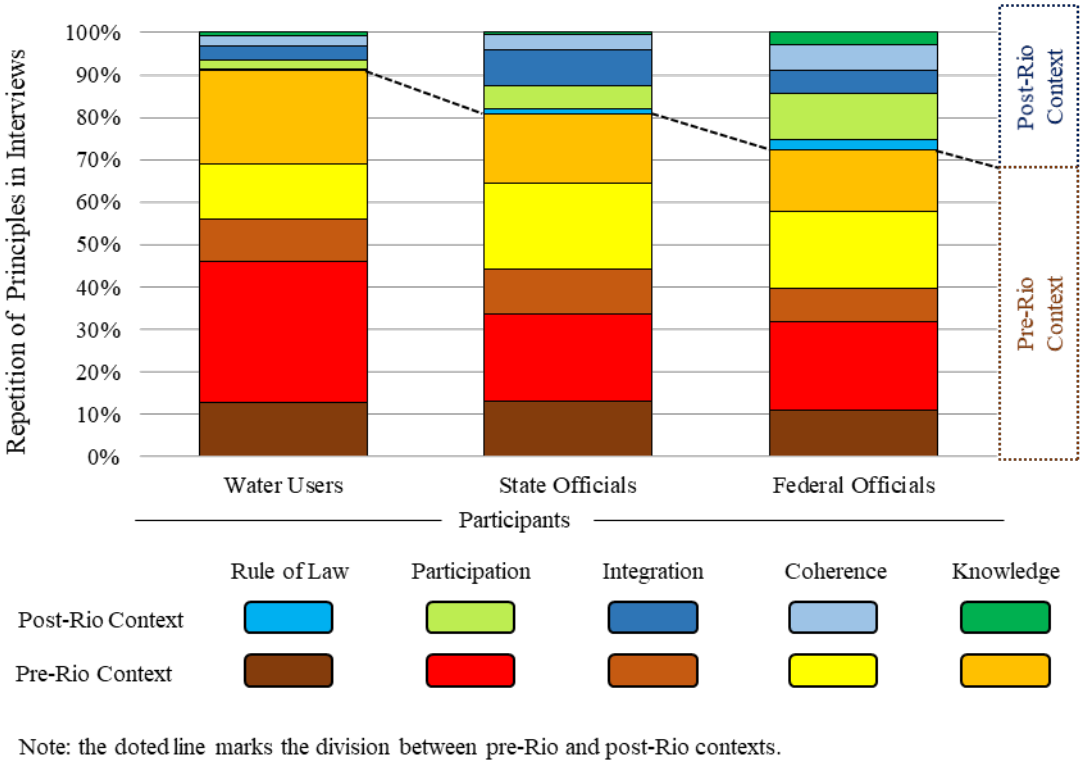
Figure 5.2: Geographical Location of States in the Lerma-Chapala Basin

When grouped by federal entity (i.e., states), results showed no striking difference in the percentage of occurrence of water governance principles (i.e., *rule of law, participation, coherence, knowledge,* and *integration*) within the interviews, among all five states in the basin (e.g., State of Mexico 83%, Michoacan 80%, Queretaro 84%, Guanajuato 87%, and Jalisco 85% of repetition of themes in an *pre-Rio context*). This suggests that there are no major differences in the accounts between stakeholders interviewed in upriver states from those in downriver states. When grouped by type of stakeholder, results show a sharper contrast. These findings together suggest that stakeholder discordance may be more prominent among different stakeholder groups rather than being based on the physical location (i.e., state) of stakeholders. This comes as a surprise, since a stronger difference between up-river and down-river was expected, as suggested by conflicts associated with the allocation of surface water, and the issue of water pollution that tends to have greater impacts down-river. While the importance of analyzing stakeholder perspectives based on

[18] Mexico began to change its top-down approach to water management in 1983, within a context of severe economic crisis. In this study, the municipal level is represented by domestic water service utilities. The law allows for these services to be privately or publicly managed, and this is probably why the law considers them as water users instead of local officials. However, in the present study all respondents for domestic water service utilities are local officials.

their geographical location is recognized, the above finding resulted in the decision to analyze stakeholder perspectives along the lines of stakeholder type.

To achieve the third study objective (Section 1.8), it was necessary to identify key themes and the frequency with which they were discussed during the interviews. The accomplishments and constraints in the implementation of water governance in the LChB are discussed in more detail in Chapter 6. Results in Figure 5.3 show relative percentages of repetition of topics concerning the five water governance principles, in a *pre-Rio contexts* (below the dashed line) and a *post-Rio contexts* (above the dashed line). The levels of repetition are characterized based on stakeholder type.



Note: the doted line marks the division between pre-Rio and post-Rio contexts.

Figure 5.3: Dominance of water governance principles discussed by stakeholders (summer/fall 2008)

Overall, results suggest that progress in the transition from an authoritarian-based approach (i.e., *pre-Rio context*) to a water governance-based approach (i.e., *post-Rio context*) in water management in the LChB has been slow. Interview results reveal that all five water governance principles were present in all interviews conducted to understand water governance in the LChB, whether in a *pre-Rio* or *post-Rio context*, or both (see Appendix VI). However, results display a predominance in the repetition of themes in a

pre-Rio context for all principles (Figure 5.3), in the responses of all three types of stakeholder groups, indicating that elements of centralized, hierarchical, state-centred, top-down approaches to water management still prevail in the LChB fifteen years after the creation of the basin council.

Results generally suggest that some level of progress has been achieved in the implementation of a viable water governance system on the ground, which is marked by the repetition of themes in a *post-Rio context* by interviewees (Figure 5.3). For example, within the *Participation, Coherence, Integration* and *Knowledge* principles in the *post-Rio context,* some government officials and water user representatives from Queretaro, Guanajuato and the State of Mexico commented on activities of COTAS[19]. These included conducting a census of existing deep-wells in the aquifer area, collecting piezometric data on dynamic and static levels of their aquifers, and identifying depletion cones in the aquifer. An example in this context was provided by a NWC official as follows:

> Little by little water users are getting more involved in water management. For example COTAS [name omitted for confidentiality purposes] are [now] doing the piezometric readings for their aquifer, […] now they know where their problem areas are [depletion cones] and they can discuss among themselves what they are going to do to solve their problems… It's not easy [to achieve this], but that is what we are aiming for (R#39).

This testimonial justifies the relevance of the proposed assessment framework. Firstly, it exemplifies the definition of *Participation* since it suggests *inclusive and legitimate multi-stakeholder representation in water-related decision making forums.* It also complies with the definition of *Coherence,* since the activities of water users in COTAS are encouraging *coordinated actions and stakeholder collaborations* (at the local scale) *in order to deliver what is needed when and where it is needed.* It also complies with the definition of *Integration* because *it is rooted in local contexts and considers existing and future water demands.* Finally, it also captures the definition of *Knowledge* which involves *making relevant information accessible to all stakeholders for the purpose of decision making.*

Other examples were provided by state officials in Jalisco, Guanajuato, and State of Mexico. They reported some forms of progress such as the construction of wastewater

[19] Spanish acronym. Authors use the same acronym for both the Technical Groundwater Committees and the Technical Water Councils. COTAS are water user organizations, which are supplementary organizations of the LChBC (see Chapter 2).

treatment facilities and pollution prevention programs aimed at reducing water pollution levels in the basin. These activities suggest a move towards embracing *Integration*, as they pertain to stakeholders collectively working towards the conservation and *long-term sustainability of water resources.* They further capture the definition *integration*, since *the basin* is utilized *as the planning and management unit*. For instance, a state water official provided insights in this regard:

> Pollution is a critical problem in the basin. We [state water commission] are talking with municipal governments and pushing forward the construction of wastewater treatment facilities. […] Many [municipalities] are reluctant, because of high operation costs (R#28).

Also, federal officials in Jalisco, Guanajuato, and Mexico City informed on progress achieved by established programs like the National Micro-basin Program and the Green Ejido[20] Program, which use a participatory methodology and address environmental, social and economic issues, in poor areas located in the higher portions of the watershed. The following quote by a federal official from the MENR highlights work that is being done in this context:

> The Ministry of the Environment and Natural Resources and the University of [Name withheld for confidentiality purposes] developed a workshop to certify the technicians that work in the Micro-basin program. […] We are going to start with the second generation of trainees… the second generation of government employees dedicated to participatory planning. But this activity is completely independent from the Basin Council (R#49).

These types of testimonials are associated with a water governance approach in a *post-Rio context*, and suggest that different groups of stakeholders are implementing programs and activities pertaining to groundwater, water quality, reforestation, soil conservation, among others, which are geared towards improving conditions in the LChB.

Interviews also revealed that *pre-Rio* based perspectives remain persistent among stakeholders, which suggests that much remains to be done in the implementation of a viable water governance system in the LChB. For example, responses from all three stakeholder groups contained a significant amount of discussion in a *pre-Rio context* under all five principles. Themes associated with *Participation, Knowledge* and *Coherence* were

[20] "Ejido" is a type of land tenure in Mexico that in general terms is commonly referred to as rural communal lands.

the ones most discussed by all three groups of informants (Figure 5.3). The following quote from a state water official demonstrates this:

> The National Water Commission still considers the Basin Council as a consultative and deliberative body that suggests or proposes actions or policies... But the NWC remains as the sole [water] authority. [From my point of view] That is a contradiction, since governance implies that the LChBC be managed with the participation of a variety of stakeholders. Furthermore, there are still no [mandatory] Regulations to the 2004 National Water Law, which complicates things because there are loopholes [...] the problem is that there are no clear rules on how civil society is to participate [...]. [Ideally,] Water users should negotiate, decide and make proposals on their own. But that requires that water users have at least some minimal knowledge. Knowledge that they don't have, but they need in order to provide the Council with founded views and opinions (R#24).

This testimonial also demonstrates the successful use of the framework proposed in this thesis. It demonstrates the lack of compliance (captured in a *pre-Rio context*) with the definition provided for *Participation,* since the Basin Council is not referred to as a *water-related decision making forum,* and is described as a consultative and deliberative body. Also, this quote explicitly mentions that water users who participate in the Basin Council do not have the necessary information on which to base their opinions, which contrasts the definition for *Knowledge* (*pre-Rio context*) with regards to *making relevant information accessible to all stakeholders for purposes of decision making,* and *to create a level ground for negotiations and quality collaboration.*

Themes associated with *Rule of law* and *Integration* were also discussed more often in a *pre-Rio* rather than in a *post-Rio context*. Pertaining to *Rule of law* in a *pre-Rio context*, respondents from all three groups pointed out the lack of law enforcement in the basin. Several respondents mentioned water pollution, while others referred to issues such as groundwater overdraft and the drilling of illegal wells which they associated with little or poor law enforcement. The following quote by a municipal water service provider best captures the diversity of responses in this context:

> There is a strong need for more enforcement in sanitation […]. There are many direct discharges into the River Lerma […] many from industry. […] Who treats the chemicals in the water? Nobody (R#17)!

In this regard, a frustrated state water official commented "what is the point of having the best law in the world is you are not going to enforce it" (R#29). Not *using the basin as the unit for planning and management* was another issue associated with the definition of *Integration* (and captured in a *pre-Rio context*) that was mentioned by all three groups of

respondents. For example, some respondents made mention of wastewater treatment facilities being built without considering their location within the basin (i.e., up-river, down-river) and treated water being discharged into the River Lerma close the discharge centre for wastewater. The testimonial by an industrial water user illustrates this problem:

> We are required by law to treat our wastewater. We also understand that it is better for the environment, and for our children, so we treat our wastewater… You should see… [Says with sarcasm and proceeds to specify a particular location on the river] There you can see our drainage pipe with clean treated water being discharged to the river, but a few meters down river is the discharge from the municipality, and is all raw sewage. It doesn't make sense… We clean our water only to become dirty again in just a few meters (R#11).

These results suggest that the viability of the water governance in the LChB is questionable because of the impact of localized projects and actions, and their outcomes have been limited. Testimonials from key informants reveal that solutions to local problems are not having a tangible benefit from a basin perspective. These issues will be further discussed in the next Chapter.

It must be noted that while discussions in the *pre-Rio context* were far more prominent than discussions in a *post-Rio context* (see Figure 5.3), there is some level of observable progress towards the implementation of specific water governance processes. This is because, in general terms, these testimonials presented in a *post-Rio context* reveal a step forward in the transition from a traditional state-centred top-down model (i.e., *pre-Rio context*), which has characterized water management in Mexico for seven decades. For example, within the *Participation, Coherence, Knowledge* and *Integration* principles in the *post-Rio context,* informants mentioned that state governments are collaborating through the LChBC in negotiations with the Commission for Hydraulic Resources of Congress, and with the Ministry of the Treasury at the federal level. Some respondents mentioned that they are engaged as a group in 'dialogue and negotiations' to obtain a special electricity tariff "like the one for agriculture" (R#27), to reduce the high operational costs of wastewater treatment facilities. The following testimonials of two state officials from two major political parties that consistently oppose each other is significant, since both officials agreed about the importance of working together "as a Council" because it helps "eliminate bureaucratic barriers" and solve common problems. The testimonials are as follows:

> We have seen that many municipalities abandon wastewater treatment facilities that have been built by the state government and transferred to them, and one of the main causes for this problem has been high operation costs. In the [Lerma-Chapala] Basin Council we

> decided to go and talk to members of [the national] Congress and ask them for a special tariff for the electricity used in wastewater treatment facilities (R#27).
>
> We have coordinated our efforts, and as a group we have appealed to the Commission for Hydraulic Resources of [the national] Congress, to the Federal Commission for Electricity, and to the Secretary of the Treasury […] This is a negotiation that still continues and we feel it is moving forward (R#36).

The relevance of these accounts is that state governments are starting to grasp the advantages of collaborating with each other and coordinating their efforts, which has not always been the case. Additionally, they are beginning to think about solving water problems that go beyond their territorial and political boundaries. This suggests that they are starting to grasp key problems and potential solutions by trying to conform to the definition of the principle of *Integration* provided in this dissertation, since they are beginning to *use the basin as the planning and management unit*.

5.2.1 Participant responses in a post-Rio context

Among specific stakeholder groups, there were notable variations in the prominence of discussions in the *post-Rio context.* While 9% of discussions by water users touched on topics related to the water governance principles in a *post-Rio context*, 19% and 28% of state and federal officials' discussions were supportive of a water governance-based approach (see Appendix VI). The main reason for this variation is that comments by participants (mainly state and federal officials) included accounts about government programs and activities like the National Micro-basin Program and Green Ejido, which are associated with IWRM. The themes that emerged in this discussion included the participation of multiple stakeholders in decision making (*Participation*) and the relevance of coordinating activities among agencies and organizations (*Coherence*).

With regards to stakeholder participation in decision making in the LChBC in particular, respondents identified the 2004 Surface Water Allocation Agreement as a landmark achievement that marked a new way for decision-making in water management in the LChBC. The 1991 allocation agreement was negotiated and signed by governments, without the participation of water users (i.e., 'little participation / governments make decisions' - *Participation*). Hence, the 2004 allocation agreement ended the long-standing trend of government making decisions without the involvement of non-government stakeholders. A NWC official provided insights in this context, while providing an example

that captures the definition of the principle *Participation* as it involves *multi-stakeholder representation in water-related decision making forums*:

> The viability of River Basin Councils was put to the test in 2004 with the [Surface Water] Distribution Agreement. Traditionally, what the President [of Mexico] said or wanted done… It was a done deal. The 1991 [Surface Water] Allocation Agreement was completely done by government [at federal and state levels]. Just government!... [In contrast,] Water users were involved from the beginning in the negotiations for the 2004 [Surface Water Allocation] Agreement. It took two years to achieve this agreement among all parties involved… because of the negotiation of the mathematical model… We finally got the Agreement, and that in part due to the contributions of the Board Member for the agricultural water use (R#44).

According to Wester, Vargas-Velazquez, Mollard, and Silva-Ochoa (2008), the 1991 agreement did not outline procedures for water transfers, which suggest a lack of transparency for solving conflicts in the LChBC. Regardless, three transfers were done from Solis dam to Lake Chapala during the 1994-2003 crisis, and these were an important reason for agricultural users from the irrigation districts to get involved in the Basin Council (Wester *et al.,* 2008). Agriculture is the largest water consumer in the basin (77%). Before 1999, there was no involvement of the leaders from the irrigation districts in making decisions that pertained to LChBC (Wester *et al.,* 2003; Wester *et al.,* 2009). Respondents generally remarked about the active water user representatives' participation in the dialogue, negotiations and decision making which resulted in the signing of the 2004 allocation agreement, which includes mechanisms for possible water transfers during times of prolonged drought. This is also reflective of stakeholders utilizing the *Rule of Law* (i.e., a treaty) to facilitate *Integration* (i.e., stakeholder decision making at the basin level). This is captured in the definition of these two principles as it depicts *the existence of strong and clear regulatory and administrative frameworks that are rooted in the socio-cultural contexts within which they function* (*Rule of law*) and the use of *the basin as the planning and management unit*, while being *rooted in local contexts and considering existing and future demands of water resources* (*Integration*).

Regarding improvements in stakeholder engagement (*Participation*), some water users acknowledged their participation in COTAS[21], while state and federal officials made mention of initiatives to promote participation such as the creation of Sub-basin Commissions. Sub-basin Commissions in Guanajuato and Michoacan were at an early

[21] Spanish acronym for Technical Groundwater Committees or Technical Water Councils.

development phase during this fieldwork, and consequently participants had little to say about their outcomes. However, respondents generally acknowledged that COTAS, Sub-basin Commissions and Micro-basin Committees, were being implemented in coordination with different institutions at different levels of government, which is captured in the definition of *Coherence* characterized by *the facilitation of coordinated actions and stakeholder collaborations at all scales*. A good example in this regard is provided by the testimonial of an official of the Ministry of Environment and Natural Resources:

> The creation of the Sub-basin Commission has been [product of] an initiative from the municipalities. They have invited us [the MENR] to join them in their meetings, as were other state and federal institutions. […] More institutions are slowly joining these meetings. […] They [the Sub-basin Commission] are setting their own goals and objectives, and compelling us [state and federal institutions] to coordinate our activities and programs to solve problems and issues identified by them (R#46).

Respondents' accounts of activities and actions such as those associated with the 2004 Surface Water Allocation Agreement and with the three types of Auxiliary Organizations (i.e., Sub-basin Commissions, Micro-basin Committees, and COTAS) shows some progress in the principles of *Integration*, *Participation* and *Coherence* within a *post-Rio context* as suggested by Figure 5.3.

5.2.2 Participant responses in a pre-Rio context

Concerning the *pre-Rio context*, variations in the amount of attention given to different principles among stakeholder groups were observed. Specifically, while *participation* was the most discussed water governance principle by all participants in a *pre-Rio context*, there were variations in reoccurrence, as themes were more constantly mentioned by water users (33%) relative to state (21%) and federal officials (21%) (see Appendix VI). Respondent's testimonials on *participation* in a *pre-Rio context* fell under two main themes 'little participation/government making decisions' and 'questionable water user representation' (Table 5.1). These two themes were discussed more persistently by water users than by the other two groups of participants. For example, most interviewees did not think that water user's interests were being represented and/or defended by water user Board Members. They also mentioned that water user representatives are ill informed to make valuable contributions and hence do not participate in the discussions. This happens in part because water user Board Members do not exchange information with those they represent. In general, Board Members lack *knowledge* about the problems and

concerns of the water users they represent, consequently resulting in those being represented not having their needs met. This testimonial by a water user representative for 'other services', who is not a Board Member, best captures the diversity of responses in this context:

> The day of the elections for Board Members at the Assembly [of Water User Representatives], we exchanged phone numbers, e-mails, and addresses among water users, and agreed that we were going to be in touch […]. After that, nothing has happened... No communication. No meeting. No nothing for over a year (R#19).

This statement illustrates discordance with *Participation* and *Knowledge* principles and provides evidence of the usefulness of the proposed assessment framework. With regards to *Participation,* the definition establishes that *stakeholder representatives should speak and/or act in the best interest of the groups they represent*. Concerning *Knowledge,* the definition indicates that *stakeholders should communicate in open and direct ways using simple and clear terminology*, which would *improve decision making, enhance stakeholder collaboration.* However, this quote reflects discrepancy with the definitions of these two principles and hence was captured in a *pre-Rio context*.

Results also show that *participation* is an area of concern for all three groups of stakeholders, and suggests that it represents an area of opportunities for improvement. During the interviews it was observed that most the water users are becoming frustrated because they do not see any tangible results or benefit in being part of the LChBC. The following quote by an aquaculture water user best reflects these problem:

> I've lost interest because they only talk and talk but there are no results […]. There is no real benefit. You cannot argue anything, and what is the point of wearing yourself out on things that have already been decided at the top by high ranking government officials (R#1).

These findings conform with Wester and colleagues (2008, 2009b), who contend that the legitimacy of the Council as a water governance forum for dialogue, negotiation and conflict resolution was undermined after the LChBC approved the third water transferred from Solis dam to Lake Chapala in 2003, regardless of strong opposition from farmers and their representative to the Lerma-Chapala Basin Council's Board of Governors. They mention that among water users, this landmark event created the impression that participating in the basin council was useless.

It is worth noting that during the interviews, some agricultural representatives recognized it was valuable to be part of the Council. For example, one agricultural

representative stated that, though they don't have much faith in the Council, they continue to engage in the 'Arrangement and Allocation Workgroup' and the 'Evaluation and Monitoring Group' of the LChBC, in order to be informed about what is happening in the LChBC, as well as to voice their concerns and defend their interests. In this respect, the following statement by another agricultural water user reiterates this view.

> I once told a high ranking official of the National Water Commission, 'These [Basin Council] meetings are a lot of talk, a lot of noise, a lot of ^#*&%@$ [expletive], and a lot of politics'. There is no work being done in the LChBC. […] The NWC created the River Basin Councils because it is required by LAW… and has to give the appearance that it is complying with the [National Water] Law… It is only to keep appearances (R#8).

Water users are also the single group who expressed more concerns related to the five water governance principles in a *pre-Rio context*, in comparison to other stakeholders. Respondents extensively discussed issues associated with the *Knowledge* principle. Specifically, they disclosed topics associated with the themes of 'lack of transparency', 'insufficient education', and 'inefficient information systems' (Table 5.1). For example, several respondents mentioned that there is no training, workshop or similar forums to bring new council members up to speed with ongoing developments and activities. Accordingly, this was viewed as having a negative impact in the continuity, productivity and quality of the work done, because of regular changes to the people involved in the Council. In this regard, it is noteworthy that most municipal officials are changed every 3 years, while state and federal officials usually change every 6 years. Water user representatives on the other hand are changed every 2 years. This problem as discussed by general respondents is exemplified by the following statement that was made by an aquaculture water user:

> We are badly informed. […] Because those who are in charge of all this [the LChBC] should send us information. Well… they don't seem to worry, because if they cared, they would have told us what can we do and how we can help. [...] If we were given a booklet, a magazine or something, then we would have something to guide us [...] but we cannot inform the water users we represent. What do we report to our people? The government do not give us training, support or advice about anything. [...] The meetings we go to are only when their [government] bosses instruct them: 'we want answers'. It is only then that the government invites us to meetings (R#2).

This statement exemplifies a discrepancy with the definition of *Knowledge* (captured in a *pre-Rio context)* since *relevant information* is not being made *accessible to all stakeholders for the purposes of education, decision making, awareness, public scrutiny and capacity building*. Several water user representatives stated that no one has provided them with any kind of information, and some even pointed out that they do not have an idea of their role

within the LChBC. In this respect, a livestock water user representative made an iconic comment, stating that: “no one has given me any information about anything. If I want to find out something about the Lerma-Chapala basin, I resort to Google” (R#13). This and other aspects are further discussed in the next Chapter.

The relative dominance of themes discussed by various stakeholders provides a snapshot of the relative levels of attention they gave to various principles in the discussion of *pre-Rio* and *post-Rio* approaches to water management in the LChB. These findings together reflect real life concerns around the basin among various stakeholders and help unearth disconnects between stakeholder perspectives on the condition of water governance in the LChB.

5.3 The implementation gap: a policy-practice disconnect

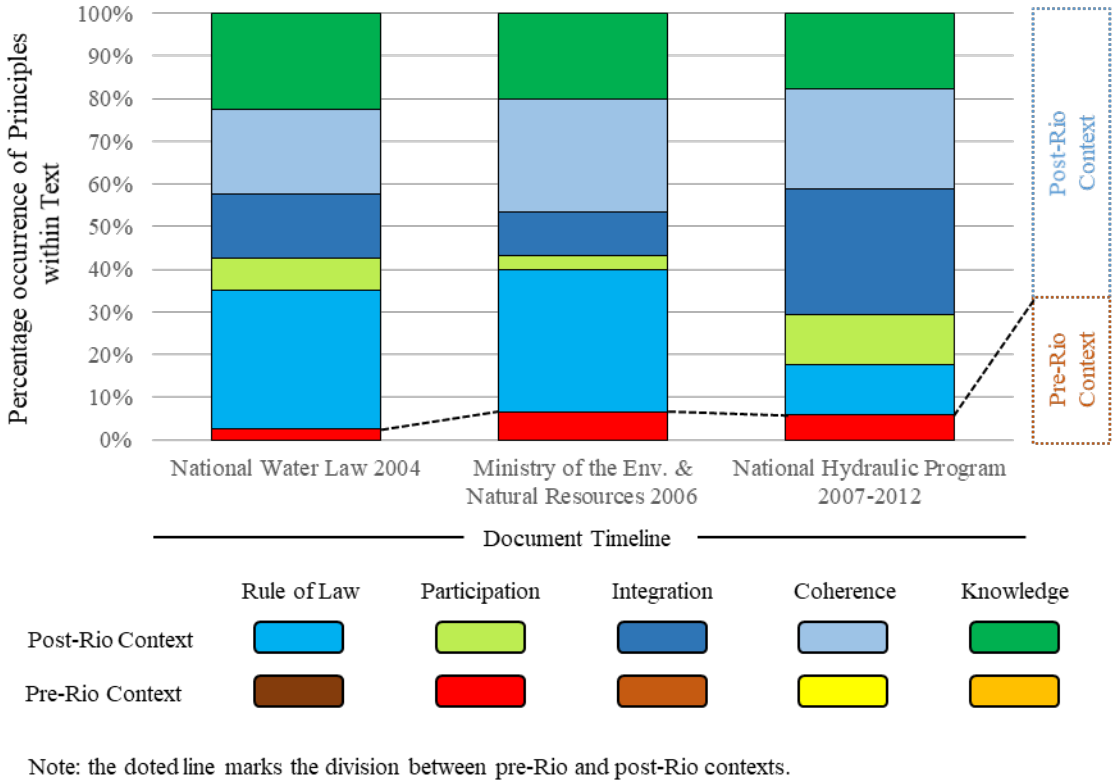
An important finding of this dissertation is the existence of an implementation gap between Mexico’s water policies and the actual behaviour of the institutions responsible for the implementation of these policies in the Lerma-Chapala basin. There are major contrasts between the results obtained from the analysis of the three types of official water documents, and the results of the interviews with key informants. Applying the proposed assessment framework to the experience of LChB made it possible to identify differences between what ‘ought to be happening’ according to official water-based documents, and what ‘was happening’ on the ground based on stakeholder accounts.

It is important to clarify here that only three official documents were used to compare the statements between official text and participants’ interviews. These three documents were the ones being enforced at the time interviews were conducted; that is, the 2004 National Water Law, the 2006 Internal Regulations of the Ministry of the Environment and Natural Resources (which includes the National Water Commission), and the 2007-2012 National Hydraulic Program. This comparison was done to determine if the water governance systems established in official documents are well reflected in practice in the LChB.

Results show that statements in all three documents are predominantly in a *post-Rio context* (Figure 5.4.), which suggests interest by the political elite in establishing an effective water governance process in Mexico, and hence in the Lerma-Chapala basin. Findings also suggest that Mexico’s policy makers recognize the importance of a viable

water governance system and (according to official texts findings in this thesis) appear to be committed to the implementation of such a system to help cope with existing water management problems. For example, Article 3, Section 15 of the 2004 National Water Law states that:

> Article 3. For the purposes of this Law, it would be understood for:
> [Section] XV. River Basin Council: A governing body that integrates mixed interests. They are forums for coordination and negotiation, support, consultation and counsel, between the [National Water] Commission, including the corresponding River Basin Organisms, and agencies of the federal, state or municipal governments, and representatives of water users and civil social organizations, of a given watershed or hydrological region (DOF, 2004).



Note: the doted line marks the division between pre-Rio and post-Rio contexts.

Figure 5.4: Dominance of Water Governance Principles Discusses in Official Documents

However, results from the interviews show a situation that is reversed. Here findings indicate that the discussion with key informants were about themes predominantly in a *pre-Rio context* (Figure 5.3). Particularly, these perspectives of key informants indicated that, to a large extent, a state-centred top-down systems of government is still being enforced in the LChB. For example, an official of the NWC stated that:

> I think that it [the Lerma-Chapala Basin Council] has not been consolidated in such a way that it could have life of its own, and I think that the National Water Commission has not done enough to achieve this [consolidation]. […] It [the Council] is a forum with little operability where the Monitoring and Evaluation Group, which is supposed to be where most of the [Council's] work gets done, doesn't do anything tangible because no decisions are being made there. And even less [decisions are made] in the Basin Council. [… Water] Users have no information or knowledge of many things. Then, the decisions that are made [in the Monitoring and Evaluation Group or in the Basin Council] are more or less what the National Water Commission wants to bring to the table. I see it [the Council] as a way to legitimize the National Water Commission's policies in the basin (R#40).

As evident in the above quote and other results that emerged in the current study, there is an implementation gap in the LChB, as 'what ought to be happening' according to the official water management rhetoric is not 'what was happening in practice' in the basin. For example, regarding the *Participation* principle, water user participation in water management in Mexico has been implemented since the enactment of the 1992 NWL, and was corroborated and strengthened in the 2004 NWL. Public participation is recognized in official documents as an important component in water governance, and River Basin Councils are the main forum for this engagement to occur through representatives from different civil social organizations (Chapter IV of the 2004 NWL). Article 13 of the NWL provides a good example of 'what ought to be happening' in this context:

> The [National Water] Commission, with the agreement of its Technical Council, will establish River Basin Councils, which are governing bodies that integrate mixed interests, as established in Section XV of Article 3 of this Law. Coordination, negotiation, support, consultation and counsel referred to by the already mentioned Section are intended to develop and implement programs and activities to improve water management, the development of water infrastructure and the respective services, and the preservation of the resources of the river basin, as well as others [programs and activities] provided in this Chapter [IV] and in the respective Regulations. River Basin Councils are not subordinate to the [National Water] Commission or to the River Basin Organizations (DOF, 2004).

As demonstrated above, Article 3 Section XV (cited in the previous page) and Article 13 of the 2004 NWL consider RBCs as *governing bodies of mixed interests* where *negotiations* among multiple stakeholders take place, in order to *develop and implement* coordinated *programs and activities to improve water management*, and to preserve the *resources of the river basin* (DOF, 2004). However, present study findings indicate that there is an implementation gap, as results from interviews indicate that there are low levels of stakeholder engagement in decision making in the LChBC. This is reflected in the voice of an irritated industrial water user when he remarked, "I'm telling you, we are 'Councilors'

in name only" (R#10)! Likewise, many respondents mentioned that all important decisions concerning infrastructure planning, development and management are made outside the LChBC. The following testimonials by a water user from 'other services' demonstrates this:

> There may be some kind of vote taken in the Council, but all decisions have been made beforehand. The National Water Commission negotiates everything outside the Basin Council and the vote is just a requirement (R#21).

Concerning the *Coherence* principle, the discrepancy between what 'ought to be happening' according to official texts and what 'was happening' in the basin, is revealed by the persistence of a centralized approach to water management and the lack of implementation of the subsidiarity principle. According to the literature, Mexico started its decentralization process in the 1980s and grew stronger during the 1990s (see sections 3.3 and 3.6). The 2004 NWL continued with these efforts and decentralized some of the National Water Commission's authority and responsibilities from its headquarters in Mexico City to its River Basin Organizations (RBO) and Local Management Offices. This decentralizing effort is illustrated in Article 12bis1 of the 2004 NWL, when it states:

> River Basin Organizations, within the hydrological regions, are technically, administratively and legally specialized autonomous units, assigned directly to the National Water Commission's Director General's office, whose powers, nature and territorial area of influence is set in this Law and is detailed in its [mandatory] regulations (DOF, 2004).

But, interview findings reveal an implementation gap, disclosed by a policy-practice disconnect. As expressed by several interviewees and in this case an industrial water user, "all important decisions are still made in Mexico City. There is only a virtual decentralization" (R#9). Similarly, many respondents commented on discrepancies around the issue of 'virtual decentralization'. For example, according to the 2004 NWL water planning is to take place at the basin level and "*Hydraulic Programs shall be elaborated, agreed upon and implemented by River Basin Organizations and River Basin Councils* […and] *these programs will be incorporated into the hydraulic programing process by river basin and hydrological regions*" (DOF, 2004: Article 15, Section II). But findings from the interviews reveal an implementation gap, since the National Hydraulic Program 2007-2012 was formed without any input from locals, including the Lerma-Santiago-Pacific RBO and the LChBC. In this context, a NWC officer commented with some surprise and disbelief:

> I do not know what criteria [the NWC] headquarters used for putting together the National Hydraulic Program 2007-2012. […] That was another squabble... There was a [national] videoconference between the NWC's headquarters and local offices where many states asked: 'Hey, where did you [headquarters] get all these information [for the NHP 2007-2012]? You [headquarters] never asked me [local office]!' The staff from the area of Programming [at our office] was very upset […]. 'Why didn't you send us the document [NHP 2007-2012] so we could give you our feedback or enrich it? Who told you [headquarters] to put those goals? How do you expect me [at the local office] to meet these goals?' The goals that headquarters established in the NHP 2007-2012 for everyone at the local offices are going to be very hard to achieve (R#39).

Concerning the *Rule of law* principle, results from official documents indicate that Mexico has a comprehensive set of rules and regulations to govern the country's water resources[22]. However, interviews reveal a gap in key legislation. According to the Third Transitory Article of the 2004 NWL, the mandatory Regulations to the NWL were to be published in the Official Diary of the Federation "*within a period not exceeding twelve months from the entry in force of this* [National Water] *law"* (DOF, 2004). In this context, findings revealed another implementation gap, as expressed in the voice of a NWC official who recognized that "The [mandatory] Regulations of the 2004 National Water Law have not been published yet" (R#44). Similarly, several respondents (mainly federal and state officials) mentioned that not having the mandatory Regulations to the 2004 NWL has created levels of uncertainty left by gaps and loopholes in the federal water legislation. The following quote by a state water official illustrates frustration in this respect:

> In practical terms, the previous [mandatory] Regulations of the NWL are still being applied […] and the 2004 National Water Law was enacted four years ago […]. Let's be clear, the [mandatory] Regulations of the 1992 NWL are not consistent with the 2004 NWL. […] The federal government establishes its water policy very well in all its official documents, but water policy is not being fully implemented, and that brings forward contradictions and uncertainty. […] It has been four years and we still don't have the [mandatory] Regulations to the 2004 NWL (R#25).

Results also revealed an implementation gap concerning information availability, which pertain to the *Knowledge* principle. Mexico's official rhetoric recognizes that information pertaining water quality and quantity, water uses and water concessions and other relevant topics related to water resources have to be widely distributed. In this context Article 13bis 3, Section XVI of the 2004 NWL states that:

[22] Other supporting water regulations include the Federal Tax Law, which was amended in 1983 to include water tariffs, and is updated every year. Also, since 1994, several Official Mexican Rules have been enacted to regulate a variety of technical aspects associated with water management.

> With support from the River Basin Organizations and their integrated monitoring and information systems, [members of] River Basin Councils are responsible for knowing, in a timely and truthful manner, the information and documentation concerning the quantity and quality of water available, as well as the existing water uses and registered water rights, and the topics and factors of greater relevance concerning water resources and their management [in the basin]. The information and documents referred to shall be widely disseminated among RBC's members and to the inhabitants of the basin [in general], enriched with the perspectives and orientations determined by the Basin Council (DOF, 2004: Article 13bis 3, Section XVI).

Despite these claims in the NWL, findings from the interviews disclose a policy-practice disconnect. Results show that not much information is being shared in practice, as reflected in the voice of a state water official who stated that "we [the LChBC] do have a fault in that respect. […] We [Board Members] have not agreed on a single information compilation and dispersion system. In that sense we do have a significant backlog" (R#27). Likewise, the testimonials of many stakeholders reveal that this gap between what 'ought to be happening' according to official water-based documents and 'what was actually happening' in practice in the LChB has left many stakeholders uninformed. In response to information about issues pertaining to policies and programs in the LChBC, respondents often answered with statements such as "I do not know" (R#10), "I have no idea" (R#13), and "I am clueless" (R#21). These responses clearly reveal the depth of the implementation gap reflected in information dissemination problems that indicate deficiencies in *knowledge*. The following statement by an aquaculture water user representative further this implementation gap:

> No one has approached me, no one has told me what is it that I am supposed to do. No one has given me any information about anything. I do not even know what my role in the LChBC is (R#4).

This implementation gap concerning the dissemination of relevant information is also having a negative impacts on stakeholder participation in the basin council. Results show that water users are growing impatient and frustrated, and several even indicated that they do not want to be part of the LChBC anymore. This finding illustrates the interaction between water governance principles, which in this case involves the lack of *Knowledge* and impacting the desire of *Participation.* The following quote by a water user representative of 'other uses' provides an excellent example in this context:

> At first I struggled a lot with the National Water Commission, asking them to give me information about the basin, to help me become more aware about water problems in the basin, to give me tools so I could do more as a representative for my [water] use. I had

> high expectations about all this work in the Lerma-Chapala Basin Council… Now, I don't care anymore. Now, I am tired of all these. Now, I don't go to meetings anymore. Now, if they want to send me [the] information [I requested], the only thing I'll do [with it] is toss it in the garbage (R#22).

Finally, concerning the *Integration* principle, results also reveal a gap between what government policies indicate and 'what was happening' in practice within LChB, according to interviews with key informants. Findings from official documents (Section 5.1) confirm that Mexico has followed an IWRM approach to cope with water problems since the publication of the 1992 NWL. Then, Mexico corroborated and strengthened its commitment to implementing and IWRM process, as illustrated in Article 13bis 3, Section I of the 2004 NWL, as follows:

> Article 13bis 3. River Basin Councils shall be responsible for:
> [Section] I. Contributing to [an] integrated water resource management [process] in their respective hydrological basin or basins, contributing to re-establish or maintain a balance between availability and use of water resources, taking into account the different water uses and users, and favouring sustainable development in relation to water and its management (DOF, 2004).

However, findings from the interviews reveal that in practice, no associated resources (e.g., forests and soils) are even being discussed in the LChBC, as expressed by an agricultural state official who recognised that "in the LChBC we only discuss water… and only surface water for that matter" (R#35). Concerning the topic of sustainability, state and federal officials mentioned that the LChBC has a Sustainability Workgroup. When questioned further about this group, they indicated that it was in its infancy. These findings provide more support for the work of several researchers (e.g., WMO & CONAGUA, 2011; Estrada Godoy *et al.,* 2013; Preciado-Jimenez *et al*., 2013; Bautista-Avalos *et al.,* 2014; Delgado-Galvan *et al*., 2014) who have reported that problems associated with groundwater over-exploitation, water pollution, and environmental degradation still prevail in the LChB. Lastly, many respondents mentioned the basin is not being used as a planning and management unit (*Integration*), and that no one is promoting the vision (*Knowledge*) of the basin as a unit, as illustrated by the testimonial of an agricultural water user who explained that "most people [in the LChB] don't know what a basin is" (R#8). This was particularly shocking because the emphasis on using the basin as a planning unit in various policy and planning documents. In this context, Article 13bis 3 (above) states that RBC's shall contribute to IWRM "*in their respective hydrological basin or basins*", and Article 13 of

the 2004 NWL (cited earlier) states that RBCs "*are intended to develop and implement programs and activities to improve water management,* […] *and the preservation of the resources of the river basin*" (DOF, 2004). Similarly, the 2007-2012 National Hydraulic Program establishes as its third objective the promotion of an integrated and sustainable management of water resources in river basins and aquifers, and states that:

> It is important to emphasize that to preserve the aquifers and rivers of the country, it is necessary to regulate [1] the use and allocation of their waters based on their availability and considering as basic premises the [pre-established] order of priority of water uses in the basin, [2] the efficient use of extracted [ground]water, [3] the gradual reduction of the [groundwater] extractions, [4] the progressive increase of the recharge for the case of the aquifers and [5] the need to maintain the minimum [ecological water] flows that must run through the rivers to guarantee the survival of the flora and fauna of each river basin. (CONAGUA, 2008a:69).

The use of the basin as a planning and management unit is latent in these three passages. This unit of management and planning is needed for "*the preservation of the resources of the river basin"*, to contribute in the implementation of an IWRM process "*in their respective hydrological basin*", as well as to establish a comprehensive allocation of water resources in the basin. Nonetheless, interview findings reveal that in general the basin is not being used as a planning and management unit, as revealed in the testimonial of several state and federal officers who indicated that they still use political boundaries as the main planning and management unit. Hence, the existence of an implementation gap. The following quote by a state water official best illustrates this context:

> Our infrastructure programs are developed by us [state government]. […] We also participate in federal programs for infrastructure development. […] We select our projects and then we negotiate the NWC. […] Several factors are taken into account, like population size, budget available, if the municipality is going to contribute with funding, and similar factors. […] No, we do not consider [geographical] location in the basin as a factor (R#27).

Based on these results it is possible to conclude that while some progress has been achieved in the LChB, there is still much to be done to establish a viable water governance system. In synthesis, findings in this dissertation identified the existence of an implementation gap between Mexico's water policies and the actual behaviour of the institutions responsible for the implementation of these policies, which involve all five water governance principles that make up the proposed assessment framework. Results reveal that there is a policy-practice disconnect concerning: (1) the participation of stakeholders in decision making (P*articipation*); (2) the collaboration of institutions and

organizations working in the basin (*Coherence*); (3) the existence of a strong legal and administrative framework (*Rule of law*); (4) the dissemination of relevant information to stakeholders (*Knowledge*); and (5) the use of the basin as a planning and management unit (*Integration)*, among others. A summary of various achievements and constraints to the implementation of a viable water governance system in the Lerma-Chapala basin is provided in Table 5.2. The implications of these results are discussed in more detail in the next Chapter.

Table 5.2: Achievement and constraints in the implementation of a viable water governance system in the Lerma-Chapala basin

Key Findings	
Achievement	Negotiations and signing of the 2004 Surface Water Allocation Agreement.
Constraint	Failure of water user representatives to advance issues that pertain to their stakeholder group in the Lerma-Chapala Basin Council.
	A fragmented, sectoral and uncoordinated approach to water management that limits the potential impact of programs and activities that are being implemented in the Lerma-Chapala basin.
	Decision making remains centralized and does not consider local context.
	Not having the mandatory Regulations to the 2004 National Water Law creates a significant gap in Mexico's water legislation.
	Deficiencies in the structure of the National Water Commission is restraining its capacity to function efficiently.

Chapter Six

6 Discussion

6.1 Strengths and opportunities for improvement of the water governance system in the Lerma-Chapala basin

This chapter analyses and discusses the constraints and the accomplishment in the implementation of a viable water governance system in the Lerma-Chapala basin. It presents the actual issues that were discussed in the interviews and compares them with what is reflected in various documents that were enforced at the time of the study. The proposed water governance principles represent a range of interrelated conditions that should be evident in an ideal water governance system. It is important to clarify that the constraints discussed here also represent opportunities for improving the water governance system.

To allow for easy reading, the occurrence of the five principles (i.e., *Participation, Coherence, Rule of law, Knowledge, Integration*) are explicitly identified within this discussion. Similarly, the occurrence of the themes that emerged from the data (i.e., 'questionable water user's representation', 'fragmentation and sectoralization', and 'lack of transparency'), which are hierarchically subordinate to the principles (see Table 5.1), are also discussed. The discussion is placed in context by integrating the study outcomes with relevant clusters of literature. Additionally, attention is paid to understanding how theory (i.e., water governance principles evident in policies) translate to practice within the LChB. Finally, a reflection on the value of the assessment framework used in the study is discussed.

6.2 Stakeholder engagement in the Lerma-Chapala Basin Council

The findings of the current study reveal that there is a distinct lack of stakeholder engagement in the Lerma-Chapala Basin Council. Findings show major disconnects between what is established in laws, policies and institutional structures, and what was happening in the LChB. Specifically, these findings disclose problems with legitimate stakeholder representation, communication among stakeholder representatives, and stakeholder participation. These gaps in implementation point towards a failure of LChBC to fully establish and facilitate a viable water governance system.

A multi-stakeholder decision-making process lies at the core of an effective water governance system. From a theoretical perspective, the water governance literature establishes that an effective water governance system creates an open and inclusive multilateral decision-making process that involves the participation of a wide range of stakeholders while minimizing stakeholder conflicts (Rogers, 2002; Moench *et al.*, 2003; Rogers & Hall, 2003; WWAP, 2003, 2006, 2015; Ashton *et al.*, 2005; WGF, 2012).

Within literature, it is also established that for a water governance process to be viable it is necessary to have vertical and horizontal networks for stakeholders and their representatives to share information and address matters that emerge at different scales across the basin (Solanes & Jouravlev, 2006; Batcheor, 2007; Tortajada, 2010a; WWAP, 2015). Informed stakeholder engagement, among other things, allows for decisions to be more in tune with the context in which issues present themselves (Peña & Solanes, 2003; WWAP, 2003, 2006, 2015; Conca, 2006). Water governance forums for decision making are considered essential, as they create a platform for stakeholders share information, brainstorm the most appropriate actions, reach common understanding, and coordinate their actions, aimed at improving water management at the basin level (Rogers & Hall, 2003; Lemos & Farias de Oliveira, 2004; Parrado Diez, 2004; Tortajada, 2010a).

On paper, Mexico's water management policies comply with these aforementioned issues, acknowledging the importance of participatory approaches to solve water related problems. This rhetoric is largely present in legislation and guiding documents such as the 2004 NWL, the 2007-2012 NHP and the 2006 Internal Regulations of the NWC. For example, the 2004 NWL establishes the following parameters around participation:

> [River Basin Councils are responsible for:] Promoting the participation of state and municipal governments, and ensure the implementation of mechanisms for the participation of the basin's water users and civil social organizations, in formulating, approving, monitoring, updating, and evaluating the water plan for the basin or basins in question, in terms of law (DOF, 2004: Article13bis 3, Section V).

In Article 13bis 1 of the 2004 NWL, an explicit structure for River Basin Councils is provided. It establishes that RBCs are subdivided into smaller administrative units at different scales; thus, establishing spatial components that attempt to bring decision making to the most appropriate level of social aggregation. These administrative units are the Auxiliary Organizations described the 2000 Basin Council Organization and Operation Rules (i.e., Sub-basin Commissions, Miro-basin Committees, and COTAS).

In the testimonials of most[23] respondents, they indicated that what was happening in practice did not follow what was established in these existing policies on multiple stakeholder engagement. These respondents often considered the legitimacy of water user representation in the LChBC as questionable. Testimonials suggest that some water user representatives were not elected by their peers. Rather, they were in some cases personally and randomly invited to participate by government officials. Several respondents even stated that water user representation in the Council is only as good as a state corporate vote for the allocation surface water, and a common statement was that water user representatives to the Board of Governors of the LChBC "only defend the interest of their state" and not of those they represent (R#4, R#8, R#16, R#30, R#43).

Article 13bis 3 Section I of the 2004 NWL establishes that water user Board Members will be elected in the Water User Representatives Assembly, but does not establish a mechanism for the election. During fieldwork in 2008, the LChBC did not have the foundation to comply with the structure provided in the 2004 NWL because of gaps in legislation (i.e., *Rule of law*). A state water official made the following remark to this effect: "The structures that the river basin councils have today are not the ones mentioned in the 2004 NWL" (R#26). By 2008, the LChBC still had previous structures in place, and elected its water user representatives to the Board of Governors as established in the Basin Council Organization and Operation Rules (BCOOR) enacted in the year 2000. Nonetheless, Articles 5 and 48 of the BCOOR are unprecise when it comes to the process that should be followed in electing these board members. Due to the absence of clear 'rules' and procedures for electing water user representatives, the Board of Governors tend to undermine the legitimacy of water user members. This in turn contravenes what is established in *Rule of law* principle.

Three main groups of water user representatives were identified based on the interviews that were conducted including (1) legitimate representatives, (2) representatives invited by government officials and (3) politically motivated individuals. The first group appears to have been chosen by their peers and may be considered as legitimate representatives. For example, the presidents of the irrigation districts, who are also water

[23] In this thesis when it states that most participants commented, it refers that 80% or more made that comment, many stands for 50 to 80%, several from 30 to 50% and few less than 30%.

user representatives for the agricultural water use in the LChBC. These leaders were elected according to their civil social organization guidelines and thus represent thousands of farmers. The second group, which includes more than a third of water user representatives interviewed, indicated that they were 'invited' to participate by state or federal officials. For example, an aquaculture water user responded that he became the representative for his water use because "the authorities always saw me as a person who knows about the issues related to my sector [aquaculture] and that is why they invited me to participate in the [Lerma-Chapala Basin] Council as representative for my use" (R#3). The third group could be described as being composed of self-promoting and politically motivated individuals. These were generally individuals who took advantage of their political affiliations and friendships to become representatives for their water use within their state. In general, these individuals had specific goals they sought to achieve. They also saw this role as an opportunity to advance their careers as politicians. During the fieldwork, it was observed that all water user representatives to the Board of Governors of the LChBC seemed to belong to the last group; thus, deviating from the principle of *participation* and various policies and regulations around water governance that were in place.

These findings point to the idea that a number of water user representatives' (including those in the Board of Governors of the LChBC), do not necessarily represent the interest of their water use group, indicating a major failure in their role. The theme 'questionable water user's representation' (Table 5.1) was one of the most prominent among water users, who commonly made statements like "I do not feel my interests are being represented in the [Lerma-Chapala Basin] Council" (R#8). This issue was also recognized by several government officials, as depicted in the following account by a NWC official who acknowledged that water user representatives seldom stand for the needs of those they represent:

> I believe that in general, water user representatives who are Board Members in the Lerma-Chapala Basin Council only represent their state's interests, and sometimes they only represent their own interest (R#43).

This lack of legitimacy of stakeholder representatives has a negative impact on the credibility of the LChBC as water governance forum. Further implications of this state of affairs include the silencing of voices and the neglect of stakeholder interests and concerns. This has a greater impact on women and marginalized groups who are underrepresented in

the LChBC. It is important to note that there were no women among the water user representatives to the LChBC. Overall, several respondents see the LChBC as a key to achieving the goals of the National Water Commission and an opportunity "to justify the implementation of its policies in the basin" (R#2, R#25, R#32; R#40).

Another important issue that was discussed by several respondents was the problem of water user representatives not getting enough information from their peers and government officials. As a result, representatives were unable to provide sufficient and relevant information (*Knowledge*) to those they represent about the activities of the LChBC. The Evaluation and Monitoring Group (see Figure 3.8), which is where most of the work done by the Council takes place, usually meets bimonthly. A one page invitation to the meeting is the only information sent to stakeholders before each meeting. This meetings usually follow the same format which include confirming and officially declaring that there is *quorum*. They then review progress on agreements reached from the previous meeting, after which seven specialized workgroups provide information about progress made by their group (if any). It is worth noting here that many participants reported that the only workgroup that is operating on a regular basis is the Arrangement and Allocation Workgroup, which is the one overseeing work related to the 2004 Surface Water Allocation Agreement. Next, the meeting involves a follow-up session on issues related to the Surface Water Allocation Agreement (which according to most participants is the utmost important issue handled by the Council), then there are presentations about government programs like the "Clean Basin Program". A sample meeting invitation is documented in Appendix X.

Findings from the interviews disclosed that most stakeholders who do not partake in the meetings only get meeting minutes, which tend to be vague and contain only basic information about the agreements reached. Respondents also indicated that stakeholders who assist in the Evaluation and Monitoring Group tend to piece together information to make sense of meetings. An example of this claim is evident in the following agricultural user statements about requesting electronic copies of presentations and/or documents after the meetings:

> … the only reason we are informed is because we go to all the meetings of the Evaluation and Monitoring Group and the Arrangement and Allocation Workgroup. Regrettably, other water user representatives usually do not go to the meetings and consequently they are not well informed. […] To be well informed, we also need to go an extra mile of requesting for further information from the meetings, otherwise, we leave with

> [information overload and] no resources that clearly articulate important aspects of the meetings (R#6).

Participants agreed that most water user representatives are ill-prepared to defend the interests of those they represent, and that their contributions to water management in the LChBC are limited because they only have partial information available to them. Hence, the theme 'insufficient education' (Table 5.1) was a major point of emphasis among all three groups of participants. Pertaining this theme, water users indicated that "no one tells you anything… If you want to know something, you have to find out by yourself… it's hectic, it's stressful" (R#17). This lack of *knowledge* is further worsened by the fact that several water users do not have a sufficient understanding of their role. For instance, water users stated that "I have no idea what my role is" within the Lerma-Chapala Basin Council (R#3, R#13, R#16, R#23). With respect to information exchange among water user representatives in particular, there were claims that there have been no meetings and no communication between Board Members and their representees since elections. A representative from the municipal water services use expressed his disappointment when he said:

> You [the researcher] are the first person that comes to see me about the Lerma-Chapala Basin Council in over a year. […] I have no clue of what goes on in the Basin Council. Things are literally dead around here [with regards to the LChBC]… We went to a meeting [at the Water User Representative Assembly] and elected a representative [Board Member] for our water use. But after that NOTHING, I mean NOTHING has happened! It's crazy, I don't know anything (R#16)!

These findings reveal deficiencies in stakeholder networks (*Coherence*) in the LChBC and further highlight the fact that information in general was not reaching those involved in negotiations and decision making. In a nutshell, it is sufficient to say that there exist deficiencies in *Knowledge*, which represents one of the principles used in this study to capture 'information systems' or thereof (refer to Table 5.1). The implications of this lack of communication is an uninformed stakeholder participation in the LChBC. Water user Board Members are not bringing forward the issues that concern their stakeholder group, mainly because they have no communication with their representees. Hence, the LChBC is out of tune with the issues that concern stakeholders at lower scales in the basin (e.g., Sub-basin Commissions, Micro-basin Committees and COTAS), and water problems at those levels are not being addressed by the basin council. Another effect of this lack of communication is that stakeholders do not know about the LChBC or its activities, and

sometimes respondents expressed their dismay when they recognized that “most people in the basin do not know that the LChBC exists” (R#4, R#8, R#12, R#26, R#50). Which raises the question of how stakeholders can become part of a participatory scheme if they are not even aware that this forum exists?

The above discussed issue also illustrates the integrated and multifaceted nature of water governance. It captures three core principles used in this study, which include *Participation, Coherence* and *Knowledge.* Pertaining the *participation* principle, the water governance literature indicates that decision making should involve multiple stakeholders (Rogers, 2002; Rogers & Hall, 2003; WWAP, 2003, 2006, 2015; Ashton *et al.*, 2005), and that voicing their concerns and defending their rights and interests through legitimate representation (WWAP, 2003, 2006; Falkenmark *et al.*, 2004; Saravanan *et al.*, 2009). Concerning the *coherence* principle, the literature suggests that vertical and horizontal information exchange networks can provide a water governance process with legitimacy, transparency, credibility, and trust, and consequently could also encourage stakeholder participation (Rogers & Hall, 2003; Solanes & Jouravlev, 2006; Batcheor, 2007; WWAP, 2015).

Finally with regards to *knowledge*, the literature considers that informed stakeholder participation can yield negotiations that are more fruitful in the definition of collaborative objectives and solutions to water management concerns (Rogers & Hall, 2003; Solanes & Jouravlev, 2006; Dore *et al*., 2012; WWAP, 2015). In this regard, Article 9 of the 2004 NWL agrees with these principles when it establishes that the National Water Commission has the responsibility:

> To promote, organize, recognize, and support water user participation at the national level, and when it is appropriate rely on state governments to do the same at state and municipal levels, with the objective of improving water resources management, as well as to encourage wide and informed water user participation, with the capacity for making decisions and taking on commitments, in terms of Law (DOF, 2004: Article 9 Section XIX).

Findings reveal a discrepancy between what it is established in the law and what was happening on the ground. The 2004 NWL establishes that the NWC has to organize water users so they can participate in water management, and sees wide and informed water user participation as something to be encouraged. But evidence shows that there is ‘questionable representation’ (*Participation*), that there is a ‘lack of transparency’

(*Knowledge*) because water users are ill informed about the activities of the LChBC. Consequently, the interaction of multiple principles point to the failure of water user representatives in their role in helping to implement a viable water governance system in the LChCB. These findings are best reflected in the words of an aquaculture water user:

> Look, they [government] have not explained a lot. We are asked to participate in the [Lerma-Chapala Basin] Council only to fulfill a requirement… There has not been any of the meetings mentioned there [at the Water User Representative Assembly]. It is as if the government just put us there [at the Assembly] to justify their work. […] Sometimes my colleagues [representees] ask me questions and the only answer I can provide is that 'I will ask the authorities because I do not know the answer'… [I believe that] In reality, the government has only considered us [water users] to fulfill a requirement. I feel helpless… Sometimes I think about quitting [as a representative] because I am [disempowered and] not helping my people (R#2).

The above quote further highlights deficiencies in the way theory translates to practice in the LChBC. While existing policies acknowledge the importance of multiple stakeholder engagement, one group of stakeholders (i.e., water users) are merely invited to passively participate with the aim of fulfilling these policy requirements, without the opportunity to introduce any change in the decision-making process. Water user representatives are poorly engaged and informed about ongoing developments and have little or no say in water management decisions.

Most respondents also indicated that participation in the LChBC takes place only as consultation, and that the Council is just a forum to provide information about progress in different government programs. These results contrast with what is stated in Article 13bis 3 of the 2004 NWL, which establishes the responsibilities of RBCs, including:

> [Section] VI. To develop, revise, reach the necessary compromises, and propose to its members, a draft of the Hydraulic Program for the basin, along with the intervention of the corresponding River Basin Organization in conformity with its authority. This draft will contain investment priorities and specific subprograms by sub-basins, micro-basins, aquifers, and vital ecosystems, within their territorial delimitation. It shall be presented as a proposal to the Council members for approval, and if necessary also for the approval of the regulatory authority. The River Basin Council will promote the implementation, monitoring, evaluation of results and feedback for the basin's Hydraulic Program (DOF, 2004: Article 13bis 3, Section VI).

This quote suggest that the type and level of participation considered by Mexican water policy allows for high levels of power sharing. Based on Arnstein's latter of citizen participation (Arnstein, 1969), the 2004 NWL considers that "trade-offs are negotiated, and there are no unilateral changes" which correspond to the third highest rug of participation in the ladder (i.e., partnership) (see Table 2.1). It also involves joint analysis of information

and shared decision-making power to achieve common objectives, suggesting interactive stakeholder involvement (Mitchell, 2002; Gomez & Nakatt, 2002). Nonetheless, interview results differ from what is stated in official texts and reveal that many respondents consider that negotiations about important issues, like financing and infrastructure development, are made beforehand by NWC and state governments, rather than through discussions and negotiations in the basin council. This issue is best depicted by the words of a NWC official when he acknowledged:

> All important decisions are made outside the [Lerma-Chapala] Basin Council. All negotiations and decisions involving programs by the National Water Commission and projects take place in a bilateral manner… [that is] between state governments and the NWC. […] In this regard it is hard not to question the role and importance of the council (R#43).

However, it is also important to point out that respondents also mentioned that there is only one relevant decision that is made in the LChBC, and that is the yearly allocation of surface water. Issues pertaining transparency in the allocation of surface water were raised by several stakeholders, which is best captured in the voice of a state water official who acknowledged "the allocation of [surface water] volumes is done based on the information provided by the National Water Commission, and no one else has the means to verify these numbers" (R#27). This issue concerning decisions being made outside the basin council is associated with the theme 'little participation/governments make decisions' captured in Table 5.1, and is reflected in the following statement by a baffled industrial water user:

> Why do they take water users to vote in the Basin Council if everything has been decided already? So we [water users] can't say we were not included? I'm telling you, it's all a PRI[24] style democracy, an autocratic rule [by the NWC] in the Basin Council (R#9).

This finding reveals that almost all important decisions were being made independent of the LChBC. According to Arstein's (1969) ladder of citizen participation, what takes place in the LChBC is 'non-participation', which indicates manipulation and is described as a 'rubberstamp advisory committee" (Table 2.1). This kind of decision making follows the traditional state-centred top-down approach to water governance (i.e., the *pre-Rio context*). Likewise, more than half of all respondents were under the impression that the Council is used to validate the federal government's water policy, while many water

[24] The Institutional Revolutionary Party, or "PRI" for its Spanish anachronism, was in power for over 70 years in Mexico, and applied a centralized state-centred top-down approach.

users expressed their frustration saying that they feel they are being 'played' with by the NWC. These aforementioned challenges of water governance are captured in the following statement by an 'other services' water user representative who was frustrated with the poor state of stakeholder engagement:

> I see the Basin Council as a kind of regulating body for NWC […] public officials control the River Basin Council […]. All decisions are finalized prior to stakeholder engagement, and the vote is just a requirement. If the government is going to continue making decision in such manner, why invite me to be part of the Council?… I think my presence at such meetings is useless. For us [water users] it is a waste of time, a waste of money, OUR MONEY. Heck! I even lose money because I do not go to work when I have to attend these meetings… It is all a puppet show, a charade… It seems that the only reason we are in the LChBC is to fill a requirement… (R#21).

The concerns echoed in the above quote were also evident in the perspective of multiple stakeholders who felt they were merely a number in the decision-making process and had no bearing on eventual outcomes. The significance of this issue is that water users feel they are being used to justify the government's policies. Several water users mentioned that they feel as if they were "just part of a checklist" (R#2, R#5, R#10, R#12, R#16, R#21), which in turn discourages stakeholders to continue or be part of this participatory scheme (i.e., the LChBC).

Applying the proposed framework in the analysis made it possible to conclude that most respondents are concerned with the low levels of participation in decision making in the LChBC. Another major benefit of the proposed framework is its ability to reveal interrelationships between different water governance principles, and their associated themes. For instance, key constraints to a viable water governance system in the LChB which emerged from the analysis of stakeholder perspectives included: (a) 'questionable water user's representation' and 'little participation/governments make decisions' (*Participation*), (b) 'legislation gaps' (*Rule of law*), (c) 'insufficient education' and 'lack of transparency' (*Knowledge*), and (d) 'fragmentation and sectorization' (*Coherence*). That is, findings indicate that there is no clear legislation for electing water user representatives, which results in a lack of transparency, and thereby compromising the legitimacy of water user's representatives. This study concludes that a key constraint in the implementation of a viable water governance system is the failure of water user representatives to advance issues that pertain to their stakeholder group in the Lerma-Chapala Basin Council.

This constraint has been confirmed by other researchers. For example, Wester, Vargas-Velazquez, Mollard, and Silva-Ochoa (2008), found that effective water user representation in the LChBC has been challenging, and that the selection of water user representatives to the Council's Board of Governors has been questionable. The findings of the present study clarify the questionable nature of these water user representatives, as it recognizes that there is no clear mechanism for the election of water user representatives to the LChBC, because of the lack of communication among most water user representatives and their representees, and because a minority seem to be legitimate representatives. Findings also confirm that water user participation in the decision-making process is nascent, based on deficiencies in *rule of law, participation, knowledge* and *coherence*. While the approach adopted by Wester and collaborators (Wester *et al.,* 2008) focuses on the negotiations on surface water allocation mechanisms, mainly through the lens of the agricultural water use, this thesis takes a more comprehensive approach and goes beyond surface allocation conflicts and considers all water uses. Thus, the current study contributes to the existing literature of the LChB as it reveals that these problems are not limited to agricultural water users alone, or just to one state in the basin.

6.3 Collaboration and cooperation to solve common water problems in the Lerma-Chapala basin

Political, institutional and occupational silos continue to support a sectoral approach (i.e., *pre-Rio context*) to water governance in the LChB. Findings indicate that information and collaboration networks are weak in the LChB, and consequently, there is no awareness about water issues involving the different water uses or about existing water-related problems in other states. As well it is clear that a fragmented, sectoral and uncoordinated approach to water management persists in the Lerma-Chapala basin, thus constraining the implementation of a viable water governance system. Results also disclose that there is no institution nor organization promoting the idea of the basin as a planning and management unit, resulting in the absence of a management plan for the basin.

Water resources management cuts across many sectors, and involves numerous and often conflicting interests and demands. As discussed in previous chapters, there have been calls for water governance systems that eliminate barriers that encourage compartmentalization and polarities among interest groups involved in water management

(Mitchell, 2013; Giordano & Shah, 2014; Grigg, 2014). Information sharing (*Knowledge*) and collaborative efforts (*Coherence*) are important pieces that could help eliminate these barriers (i.e., hindrances to *Integration*). The literature also contends that knowledge and information should be shared both vertically and horizontally to enable the coordination of collaborative activities (Rogers & Hall, 2003; Solanes & Jouravlev, 2006; Tortajada, 2010a). Sharing knowledge and information also helps establish networks, raise awareness, and build empathy among stakeholders (Moench *et al.*, 2003; WWAP, 2003, 2012, 2015; Biswas & Tortajada, 2010a; FAO, 2013). Also, informed participation at all levels permits more fruitful negotiations for the establishment of collaborative efforts (*Participation*), which in turn support the integrated management of water resources and an effective water governance process (Rogers & Hall, 2003; Solanes & Jouravlev, 2006; WWAP, 2015).

Results in Section 5.3, confirm that an enabling policy environment has been established in Mexico for the implementation of water governance system and the application of an IWRM approach. In this sense, a participatory collaborative and coordinated approach is considered as the best way forward in the narrative contained in the official documents (i.e., 2004 NWL, in the 2007-2012 NHP and in the 2006 Internal Regulations of the NWC). Article 5 Section I of the 2004 NWL captures the diversity of statements that have been made in this context by establishing the following guiding principles:

> Article 5. For compliance and enforcement of this Law, the Federal Executive branch [through the National Water Commission]:
> [Section] I. Will promote the coordination of actions with state and municipal governments, without infringing their authority and within the range of their respective responsibilities. The coordination of actions concerning planning, implementation and management of water resources by river basin or hydrological region will be through the River Basin Councils, where the three levels of government converge, and water users, citizens and civil social organizations participate and assume commitments, under the provisions of this Law and its regulations (DOF, 2004).

In contrast to the narrative in official documents, most respondents commented about the existence of fractures that divide stakeholders and limit the impact of collaborative efforts in the Lerma-Chapala basin. This refers to the ‘fragmentation and sectorization’ theme that pertains to the *Coherence* principle. Through the interviews, it was possible to observe that most respondents look at the basin’s water management problems from their own personal perspective, influenced by their political, institutional,

occupational, and professional biases and interests. For example, government officials at all three levels[25] often made comments based on their affiliation to the three main political parties (i.e., federal government – National Action Party, state government – Party of the Democratic Revolution, and municipal government – Institutional Revolutionary Party), or on the government agency they work under (e.g., agriculture, environment, water, or public works).

Also, it was observed that many respondents were familiar only with water management issues within their own state and/or line of work. Some participants had a vague idea of specific issues in neighbouring states or other water uses, while a few were familiar with the main water related issues in the basin. Answers like "maybe some issues" (R#11) or "I assume they have the same problems that we do" (R#3), were not uncommon. This 'lack of education' and information (*Knowledge*) has resulted in a 'fragmented and sectoral' approach to water planning and management in the basin. The significance is that this fragmented vision of the basin has done little to promote empathy among stakeholders, and in turn has limited the opportunities for the establishment of 'cooperation and collaboration' activities geared towards a common goal (*Coherence*). In this context, several respondents commented that everyone in the LChBC looks after their own interest, and defends their turf. In the words of an agricultural state official for instance, "all activities are independent of each member of the [Lerma-Chapala Basin] Council. We do not work as a group" (R#35). Clearly such disconnects do not create an enabling environment for an integrated approach to water governance.

Likewise, participants indicated that some stakeholders even consider that they must compete with other states and secure more surface water for their state (R#6, R#28, R#36, R#42). This suggests that stakeholders in the LChBC do not plan or think of the basin as a management unit (*Integration*), because they only protect their state's interests. Evidence of this fragmentation and their implications for *knowledge*, *coherence* and *integration* are exemplified in this quote from a state water official who claimed that "when we go to the meetings [of the basin council], our main duty is to defend our state's rights, and that of our water users, to [surface] water resources" (R#28).

[25] The great majority (if not all) drinking water and sanitation service utilities in the Lerma-Chapala Basin are managed by the municipal government; hence, the use of the term municipal water services to label this water use in Appendix VIII.

Similar claims related to the 'fragmentation and sectorization' theme (*Coherence*) were made by other participants such as NWC officials (R#39, R#40, R#42), state environmental officials (R#30, R#33), and agricultural, industrial, aquaculture water users (R#1, R#3, R#6, R#8, R#9, R#11). These fractures together show another theory-practice disconnect in which existing policies aimed at creating effective collaboration networks and stakeholder integration, are not reflected in practice because of the self-interested behaviour of stakeholders which, in part, stems from the lack of information.

Maganda (2003) confirmed the presence of fractures or silos when she acknowledges institutional rivalries between national, state and local water authorities, triggered by institutional reforms that resulted in lack of clarity pertaining institutional roles within the LChB. She also argues that this competition among water institutions has negatively affect water planning and management in the LChB. However, her study only shows a partial picture of the basin because the focus of her research was on water politics in Guanajuato, and the institutional conflict with the NWC (see Section 3.5). This thesis expands on existing knowledge because it includes all five states in the basin and shows that 'fragmentation and sectorization' is a problem exists at multiple levels and manifests itself within and among different stakeholder groups across the basin.

Many respondents also talked about existing programs and activities associated with water governance forums that are being implemented in the LChB by different institutions and organizations with their own budgets and personnel[26]. However, fragmentation is a major limitation in the establishment of collaborative efforts in the basin (*Coherence*). This is in part caused by the lack of a single plan of action for the basin (*Integration*), which was an issue mentioned by several respondents. The following quote by a state water official best captures the diversity of responses in this respect:

> There have been some efforts made to put together a plan [for the basin]… I believe that the best attempt to put together information about the basin was made by Helena Colter with her 'Atlas'. She provides very valuable information, but it is an atlas… not a plan. […] Someone should sit down and talk to people [stakeholders] and put together a plan

[26] The National Micro-basin Program (Programa Nacional de Microcuencas) in MALRDFF, and the Green Farm Program (Programa Ejido Verde) in MENR, and the establishment of Sub-basin Committees in Michoacan are examples provided by respondents regarding established programs in the LChB that use water governance forums to cope with environmental, social and economic issues and rehabilitate the higher portions of the watershed.

> that considers the entire basin. […] It would probably have to be the [LChB] Council… Ha, ha, ha [satirical laugh]! And who would that be?... The NWC (R#25)?

Without a plan for the entire basin, the impact of programs, budgets and activities of institutions and organizations is dispersed. Some respondents recognised that these isolated efforts of institutions and organizations have little impact on solving present problems. Some respondents also talked about collaborative activities that are not linked with the LChBC that have been established to improve water conditions in the basin. The common denominator in these collaborative networks (*Coherence*) was that they have been established because of good working relationships between individuals in decision-making positions. The following quote by an official of the Ministry of the Environment and Natural Resources provides an excellent example in this context:

> We have a collaborative program between the municipality, PROFEPA[27] and the NWC. […] This are coordinated visits to [different] industries and we avoid problems with lack of clarity [gaps and overlaps] concerning institutional roles and authority. Before the industrialist would question who had authority and argue that it was someone else's role. Now we go together and we can cover all angles. […] What happened is that my boss is very well connected and knows a lot of people, so she talked with some people and now we have a collaboration agreement (R#48).

The present framework made it possible to identify aspects of informal systems creating synergies, conjugating actions, and having a greater impact in benefit of the basin. Nonetheless, from the formal perspective, these informal networks are not complementing the efforts of the Council. This is interpreted here as a lack of *coherence* due to the 'fragmentation and sectorization' of water related activities in the LChB.

'Fragmentation and sectorization' also restrains vertical and horizontal information flows. With regards to the LChBC, almost all respondents acknowledged that information that is provided during meetings (to those who request it), does not flow beyond its Board Members and the state and federal officials directly involved in the Council. Thus, there exist differences in *Knowledge* dissemination. Officials from the NWC stated that they send the Minutes of the meetings via email to the members of the Council. However, most water users (who are not Board Members) indicated that they do not get any information or that they do not read the Minutes. Consequently, a common answer during the interviews was "I do not know" (R#2, R#13, R#19). These findings together show that the top-down

[27] Spanish acronym for the Federal Attorney's Office for Environmental Protection.

and bottom-up flow of information (which is considered as central to a successful water governance system) are very weak at best. This further discloses deficiencies in transparency (i.e., the principle of *Knowledge*). Stakeholders involved in the Council tend to work and act independent of each other, which results in the structure of the LChBC being fragmented (*Coherence*) and no synergies being created. In line with the aforementioned problems of 'fragmentation and sectorization' and 'lack of transparency', a frustrated livestock water user remarked:

> It is WRONG! Information is not reaching any water users. It's getting to NOBODY! For instance, none of us [in the livestock association] knew about the existence of COTAS nor of the River Basin Council... (R#12).

Many respondents stated that water users in the LChB do not understand the concept of a "basin". Several respondents also indicated that there are awareness campaigns in the basin. However, these awareness activities are carried out by state and municipal institutions and are aimed at addressing local problems, activities and programs. But they do not promote awareness about water resources issues beyond the institution's area of influence. In this respect, a water user representative for municipal water services commented that:

> Here, at the municipal level, we work on raising awareness through our 'water culture' program, which we finance with our own budget. […] Combining efforts with the state government is not possible. There is the issue that we belong to different political parties. Also, our awareness campaigns have different messages… even slogans and logos are different. […] Collaborative efforts with the state government are considered taboo, by both sides. We finance our 'water culture' programs and we cover topics that are of our interest (R#18).

Most respondents agreed that there are no awareness activities concerning the basin, or platforms promoting the basin as a management unit. There are no activities informing the population that there is a River Basin Council, its purpose, associated participants, and related activities and achievements. In this respect a NWC official stated that:

> No, there is no one promoting the idea of the basin as a unit. That is something we are still missing in the basin. There hasn't been anyone that says 'let's look at things from an integrated water resource management perspective.' […] We still do not see a situation [in the LChBC] in which state representatives see the problem and the solution through the standpoint of a basin. Each one of the representatives still go to the meetings with a local perspective [or point of view] (R#42).

Findings from implementing the framework presented in this thesis led to the conclusion that 'fragmentation and sectorization' does not allow stakeholders to visualize the basin as

unit, resulting in one dimensional activities which only serve their respective interests. For example, a NWC official reflected on this problem as follows:

> You have to make people aware that they are part of the basin. They do not even know what a basin is. [...] The basin concept does not exist for them. So then, how are we [the National Water Commission] going to take action at the basin level if those living within the basin do not know they have common problems and that they are part of common solutions? So much work needs to be done… starting at the grassroots level. Work that hasn't been done since the beginning [when the LChBC was created]… We [the NWC] have lagged behind and we are still not raising awareness about the basin. We are still not increasing awareness and it is still not considered to be important by those making decisions (R#40).

By applying the proposed water governance framework in a content analysis of interviews, it became evident that most respondents expressed disappointment about the lack of coordination and collaboration among stakeholders (*Coherence*), and the slow rate of progress in solving water management problems in the basin. This is illustrated by the testimonial of a state water official who indicated that:

> Progress is too slow and we grew anxious very quickly, so we asked ourselves: 'What do we need the Basin Council for?' We are doing everything with our own programs and resources anyway (R#26).

Other key constraint that emerged from the analysis of interrelationships between several water governance principles in the interviews included: (a) 'fragmentation and sectorization' (*Coherence*), (b) 'insufficient education' and 'lack of transparency' (*Knowledge*), and (c) 'regional development' as opposed to 'basin planning and management' (*Integration*), which expose key constraints to the implementation of a viable water governance system. This helps build on the pioneering work of Ashton, Patrick, MacKay, and Weaver (2005:452), who were the first to emphasise that "it is the integration and inclusion of all these principles that underpins the definition of good governance".

Findings reveal that stakeholders are not aware of the problems that afflict other water uses in their state or other states, and this does not allow them to appreciate the need for collaborative actions to solve common problems. The implication is that their partial knowledge of the water problems of the basin limits their options because they are not aware that the solution to some problems present in one part of the basin could be found in other parts of the basin; hence the lack of a holistic approach to problem solving. Findings show that the LChBC does not properly inform its stakeholders (or the general population of the basin) about existing management problems, about its initiatives aimed at solving

these problems, or promote the idea of the basin, and therefore does not promote the potential of the water governance forum as a tool to implement an IWRM process. This study concludes that another key constraint to the implementation of a viable water governance system is the presence of a fragmented, sectoral and uncoordinated approach to water management that limits the potential impact of programs and activities that are being implemented in the Lerma-Chapala basin. Although the value of well-coordinated approaches to water governance are acknowledged within existing policies and plans, they manifest poorly in practice.

6.4 Decentralization policies for the water sector

Power and authority remains concentrated in Mexico City. Findings reveal an implementation gap between what is stated in official documents and what was happening in practice in the LChB. Results from the interviews indicate that decentralization has been achieved only partially, and that decision making in the water sector remains for the most part centralized. This implies that local context is not considered in decision making, planning, and management of water resources in the LChB.

The transfer of power and authority to lower levels of authority (basin level) involves the principle of subsidiarity. For a water governance system to be viable it is necessary to plan and transfer management authority to several administrative and geographical scales (Rogers & Hall, 2003; WWAP, 2003, 2006, 2015; Tortajada, 2010a). As discussed in Chapter 2, water governance calls for the elimination of high-handed decisions, with the aim of ensuring that decisions and actions are more in tune with the context and scale in which issues present themselves (Rogers & Hall, 2003; WWAP, 2003, 2006, 2015; Conca, 2006). An effective and efficient water governance process should adequately respond to local issues, and consequently, be able to deliver what is needed, where it is needed, and when it is needed (Peña & Solanes, 2003; Rogers & Hall, 2003; WWAP, 2003, 2006). Therefore, the theme decentralization to the lowest relevant scale, associated with the subsidiarity principle, is considered an important element for establishing an effective water governance process.

In that sense, Mexico has followed decentralization policies since the 1980s (Rodriguez, 1997), and the narrative in the 2004 NWL, the 2006 Internal Regulations of the NWL and the 2007-2012 NHP follow the same pattern for the water sector. The official

narrative mainly revolves around improving water efficiency and water services through the transfer of responsibilities to local levels of government and civil social organizations. It also encompasses the consolidation of institutions and organizations involved in planning, developing, managing and conservation of water resources, which is a process that (in theory) began two decades earlier (see sections 3.3 and 3.6). For example, the 2007-2012 National Hydraulic Program (NHP) states that:

> Regarding the decentralization of power, we [the federal government] will continue with the transfer of authority, roles, programs, responsibilities and resources from the federation to state governments, municipalities and water users, to bring government and citizens closer together, to improve outcomes in the sustainable management of water resources, to expand joint responsibility of all three levels of government, to strengthen management capacities and to increase administrative efficiency of the government as a whole (CONAGUA, 2008a:76).

In contrast, most respondents interviewed contended that decentralization has not been complete, stressing that it has been partially achieved, or that it only exists on paper. They mentioned that decisions regarding water policy, planning, development and management are still being made at the NWC's headquarters. For example, a state water official emphasized that "things are still done in the same way. […] They are decentralizing the National Water Commission, but decisions are still made in Mexico City" (R#24). Similar claims were echoed by all three groups of participants. Some interviewees indicated that the headquarters still provides the final approval for most federal programs like those for the construction or maintenance of water related infrastructure; even when the programs have been transferred to state governments. A few respondents stressed that this happens mainly because headquarters still authorizes and releases the federal funds assigned to those programs. Further insight into this process is detailed by a state water official in the following quote:

> It depends on the way the project is funded. If the money comes from the state treasury, then the negotiation is between the municipality and the state government. […] Now, when projects are [partly or fully] funded by federal programs […] then negotiations involve municipal, state and federal governments. […] Once we have everything approved by the NWC's Local Office, then the entire package [for each program] is sent to Mexico City [NWC headquarters] for [final] approval (R#26).

Consequently, in 2008, there were areas within NWC that were still carrying out activities that should have been already transferred to state governments, municipalities or water user organizations. This problem is captured in the following statement by an official of the Ministry of Agriculture, Livestock, Rural Development, Fisheries and Food (MALRDFF).

> All irrigation districts where supposed to be transferred completely to Water User Organizations by now… that was the idea. But [areas working on] irrigation districts continue to exist within the structure of the National Water Commission. Today there is in the NWC the office of the Chief of Operations, and the office of the Chief of Irrigation and Drainage Engineering. What was transferred [to Water User Organizations] was the operational part, but the government still keeps control of irrigation systems. [...] Planning for the irrigation systems is still carried out by NWC. There is no real transfer still (R#51).

Another form of decentralization contained in Mexico's policies pertain to River Basin Organizations (RBOs). The 13 Regional Management Offices (see Section 3.6) created with the publication of the Internal Regulations of the National Water Commission in 1993 (SARH, 1993), were transformed into RBOs by the 2004 National Water Law. RBOs are defined in Chapter III Bis of the 2004 NWL as technically, administratively and legally specialized autonomous units assigned directly to the Director General's Office of the National Water Commission, and are not subordinated to any other areas at NWC's headquarters (DOF, 2004). This means that RBOs are mandated to follow the subsidiarity principle by bringing decision making closer to the basin level. However, many respondents acknowledge that centralized-bureaucratic top-down systems remain persistent. As an industrial water user representative remarked "… decentralization has occurred in structure but not in decision making…" (R#9). Many respondents also agreed that water policy and programs are not developed at the basin level. These statements are in opposition with what is established in the 2004 NWL and the 2006 Internal Regulations of the NWC. For example, several respondents indicated that even simple decisions like granting or renewing water concession certificates, which according to the 2004 NWL should be done by the RBOs (Article 12bis 6, Section XIII), are still being executed at the NWC's headquarters in Mexico City. The following testimonial by a NWC official provides further insight to this regard:

> Water concession certificates are made here and then they are validated Mexico City. [...] The main argument is the workload, and headquarters has more staff. But in an IWRM approach, we would have to manage water concession certificates at the basin level, and that is the spirit of the [2004 National Water] Law [...] I suppose it is part of a process, and we would need a change in mentality (R#43).

The concentration of simple activities at the NWC headquarters has been creating administrative and management problems in the water sector. The irony is that by complying with the law by decentralizing responsibilities to lower levels of authority (i.e., RBO), the NWC could mitigate a number of problems, while making the institution more

responsive to local needs. For example, the inefficiency of a centralized water concession renewal process was creating problems at the NWC's Local Management Offices, mainly because of delays in issuing certificates which typically take many years. A water user representative for 'other services' provides further insight in this regard when he comments in disbelief:

> I went to a big political event with the Mayor, NWC officials, and other prominent personalities, to deliver groundwater concession certificates […] what made me laugh was that we got our certificates eight years late […]. The big deal was that at the event we were told [by the NWC] to start the renewal process because the concessions are for ten years. […] There was an important number of wells that got their certificates delivered that day, and there were people [water users] that got their concessions and these had already expired […]. It is then when you tell yourself: 'Eight, ten years late? Things move very slowly in the NWC!' (R#20).

Based on these findings, this thesis concludes that the centralization of decision making at the NWC's headquarters opposes the subsidiarity principle, thus presenting a challenge for the establishment of a viable water governance process. The following quote by a NWC official captures the diversity of responses in this context.

> Supposedly, with the decentralization [of NWC], River Basin Organization would gain strength managing their own budgets and work their programs at a basin level, and in theory Local Offices would be dependent from the River Basin Organization and not from Headquarters […] But in reality IT DOESN'T HAPPEN THAT WAY! Because decision making and water policy are still marked by [NWC's] headquarters (R#40).

The creation of River Basin Councils (RBCs), such as the LChBC, is also part of Mexico's decentralisation policy in the water sector. RBCs are to exercise their functions through Auxiliary Organizations that work at different scales (Figure 3.9), which in essence complies with the subsidiarity principle. This study found a major inconsistency between the official documents and what was happening on the ground. This policy-practice disconnect tends to constrain progress in the consolidation of the LChBC. In this respect, most respondents agree that there has been no decentralization of responsibilities from the NWC to the LChBC or its' Auxiliary Organizations. Participants also consider that decentralization has not diffused from Mexico City to the Basin Council.

Some progress has been made with regards to public participation in water management and the creation of several COTAS and some Sub-Basin Commissions in the LChB. However, most respondents stated that these water user organizations are not linked with the Basin Council (*Coherence*). All work in the LChBC is restricted to issues at the

basin level (i.e., allocation of surface water) and does nothing related to smaller scales which would involve its Auxiliary Organizations. This thesis exposes the existence of limited collaboration and coordination activities between the LChBC and its Auxiliary Organizations. The following quote by an official of the NWC best captures this challenge:

> There is no link… There is no strategy… [Sub-] Basin Commissions and COTAS are part of local initiatives. There is no line of action provided by [NWC's] headquarters. Headquarters support the creation of [Sub-] Basin Commissions and COTAS, but there is no strategy… At least I do not think there is [a strategy]! … Headquarters have not addressed the issue of how to link the Basin Council with the [Sub-] Basin Commissions, or with COTAS. […] I believe that the NWC does not know what to make of the River Basin Councils… It's a bit like Alice [a character from Lewis Carroll novel]… If you don't know where you are going, it doesn't much matter which way you go (R#39).

There is evidence that progress has been slow because of the inherent constraints placed by traditional autocratic forces within the NWC that do not see water user engagement as an essential component in a viable water governance system. The following quote by a state water official illustrates the context in which water user participation has developed in Mexico and the LChBC since the enactment of the NWL in 1992:

> I believe that in the beginning there was an intention to establish public participation in decision making. The Basin Council project design was put together [before 1992] by Eduardo Mestre, based on French and Spanish examples. In 1997, Mestre is replaced by Guillermo Chavez Zarate and he puts into practice what the 1992 National Water Law established. […] Internal resistance did exist within the National Water Commission, from strong and traditional sectors where the style of government is unilateral [authoritarian], 'I do not need to allow others to participate, especially not water users,' thus was perceived. […] Of course, they never put it in writing (R#24).

This thesis reinforces the idea that institutional organizational legacies have a dominant role during regime change (i.e., from *pre-Rio* to *post-Rio*), and consequently, they have the potential to facilitate or restrict progress in the transition from the old to the new water management model (i.e., IWRM). This idea is also supported by the work of various researchers who consider that the legacy of institutional arrangements can facilitate or restrict the role played by stakeholders; thus, determining the (un)successful implementation of a viable water governance system (Farrelly & Brown, 2011; Horlemann & Dombrowsky, 2012; Oliveira *et al*., 2012; Franzen *et al*., 2015; Boer *et al.*,2016).

Similar finding emerged in the work of Wilder (2010), who states that Mexico's decentralization agenda has been only partial and very incomplete, stressing that water policy appears stuck in a transitional phase for almost twenty years. Wilder (2010) also

points to related issues such as political fragmentation, potential challenges to the *status quo* and at the lack of strong political will as possible explanations for policies and laws not being effectively implemented. Her research is different in the sense that it uses a policy science approach. The present study validates Wilder's work by including a more diverse set of voices to this research context. Specifically, while Wilder's study relied on the voices of irrigation districts and water institutions, the current study includes the voices of various water uses, environmental and agricultural officials, as well as state and federal executives. Also, while Wilder focused on efficiency, decentralization and sustainability principles, the present study looks at a broader scope of issues in the context of the five proposed water governance principles.

Most participants agreed that policy and decision making remains largely centralized at the National Water Commission's headquarters. Results confirm what has been previously established, that there is an interaction among principles and their associated themes, which point to the existence of a constraint for the implementation of a viable water governance system. In this case, the themes which were mentioned by most participants are related to: (a) 'centralized decision making' (*Coherence*), (b) 'regional development planning and management' (*Integration*), (c) 'lack of transparency' (*Knowledge*), and (d) 'little participation/governments make decisions' (*Participation*). Findings also show that the NWC has not decentralized authority to its River Basin Organizations nor does to the River Basin Councils. Decisions continue to be made in a top-down manner by the NWC's headquarters, since the authorization of federal fuds are still controlled from Mexico City. This finding also suggests that the 2004 NWL is being partially applied at best, which raises questions regarding transparency and accountability. This thesis concludes that the key constraint in this case is that decision making remains centralized and does not consider local context.

6.5 The rules for managing water resources in the Lerma-Chapala basin

There is a noticeable gap in key water legislation in Mexico. Findings disclose management and structural issues such unregulated water banks, and uncertainty in the roles and authority of RBOs and RBCs, due to the lack of detailed regulations. Not having the mandatory Regulations to the 2004 National Water Law has left a significant gap in

Mexico's water legislation, which represents another constraint to a viable water governance system.

The literature specifies that a strong legal and administrative framework is a cornerstone in the establishment of an effective water governance system (Moench *et al.*, 2003; WWAP, 2003, 2006; UNDP, 2004; Grigg, 2011). Consequently, it is important that the 'rules of the game' and the roles of stakeholders are clearly defined and publicly disclosed, and that authority is exercised and enforced impartially and in accordance with established rules (Rogers & Hall, 2003; WWAP, 2003, 2006). From a theoretical perspective, a strong legal and administrative framework should bring legitimacy, clarity, transparency, order and credibility to a water governance process while reducing arbitrary actions and decisions.

The literature acknowledges that Mexico has been supported by a strong legal and institutional framework for over eight decades (Dourojeanni & Jouravlev, 2001; Mestre, 2001a; Dourojeanni *et al.*, 2002). The existence of a legal and institutional framework is confirmed by the eighteen documents analysed in Section 5.1, which span over three decades and include laws, policies and institutional structures for the water sector. Also, results in Section 5.3, establishes that the content of the 2004 NWL, the 2007-2012 NHP, and the 2006 Internal Regulations of the National Water Commission, have are enough elements (on paper) to establish a viable water governance system in the LChB. The following quote illustrates how the general objectives of the 2004 NWL allude to the *rule of law*.

> ARTICLE 1. This Law regulates Article 27 of the Mexican Constitution [of 1917] in matter of the nation's waters, and is of general abidance throughout the entire national territory. Its provisions are of public order and social interest and its purpose is to regulate the exploitation, use or utilization of the nation's waters, their distribution and control, as well as the preservation of their quantity and quality to achieve their sustainable development (DOF, 2004).

However, there is a discrepancy between theory and practice, as many respondents identified existing legislation enforcement deficiencies (*Rule of law*). In its transitory articles, the 2004 NWL state that its mandatory Regulations should be enacted "within a period not exceeding twelve months from the entry into force of" the reforms to the NWL (DOF, 2004: Third Transitory Article). Nonetheless, many respondents acknowledged that the mandatory Regulations of the 2004 National Water Law had not been published.

Consequently, the 2004 NWL law cannot be fully enforced in the LChB, nor in any other basin in Mexico. The Regulations being enforced during fieldwork (July-October 2008) were the Regulations of the 1992 NWL, which according to several respondents have become for the most part obsolete[28]. A NWC official provided further insight and reiterated the above view when stating:

> The Regulations of the 2004 National Water Law have not been published yet, but we still have the previous ones. […] We thought that the Regulations of the 2004 NWL would come out shortly after the publication of the Law. […] With regards to river basin councils, […] we have consulted with the legal areas [of the NWC's headquarters,] and there are parts that are not ruled by the Regulations of the 1992 NWL. There are also many problems with 'Water Banks' […]. There is a great gap in water legislation that the legal areas of the National Water Commission are trying to substantiate through legal processes, without transgressing the [National Water] Law (R#44).

There are several topics considered in the 2004 NWL that were going to be further addressed in its mandatory Regulations. However, this 'legislation gap' (*Rule of law*) has left an assortment of topics without detailed regulations; thus, creating a variety of challenges related with water management. Among the topics that were discussed by respondents were 'water banks,' the roles and responsibilities of RBOs, and the restructuring and operation of River Basin Councils.

Groundwater overdraft is one of the main water management problems in the in the LChB. Nonetheless, water users and state government officials complained about the lack of control in the extraction of groundwater resources. They referred to existing issues like the arbitrary allotment of groundwater volumes ('lack of transparency' - *Knowledge*) and the unreliability of the data in the Public Registry of Water Concessions ('inefficient information systems' - *Knowledge*). Water banks are described in the 2004 NWL as bodies "in which the regulated operations for the transfer of water rights will be managed, and whose functions will be established by the respective regulations" (DOF, 2004: Article 37bis). The law provides for the application of water banks, but no mechanism had been institutionalised to regulate them because of the 'legal gap'. Several water users and government officials mentioned that there is an urgent need for detailed regulations on

[28] The Regulations of the NWL available on line, accessed on April, 11, 2017 from the Chamber of Deputies of the Congress of the Union Web Page http://www.diputados.gob.mx/LeyesBiblio/regley/Reg_LAN_250814.pdf are those published on January 12 1994, and the last reform to this legal document is dated as August 25, 2014. It important to note that the last reforms to Chapter III on River Basin Councils are the ones made in 1997.

water banks. They commented about irregularities and abuses, as volumes were being bought, sold and transferred in an unregulated market. Pertaining these issue water users indicated that "volumes [of water] are being bought and sold, but there is no one checking them..." (R#9), and no agent "who keeps records of all these transactions" (R#19)? or "how do [potential] buyers know who has [excess] volumes to sell." (R#15) Some respondents even suggested problems concerning corruption, exemplified in the following quote from an agricultural state official's discourse:

> Supposedly there is no more water available to allocate [in the LChB]… But in practice, you realize that there are groundwater concessions with volumes that are not being used, that they have been allocated more water than they need, and that in some cases these excess volumes are being used to do business […]. The National Water Commission says that the only option if you want more [ground] water [in the Lerma-Chapala basin] is to purchase water rights through the water banks… But, there is no regulation for these water banks. Where are this water banks? How do I buy or sell volumes?... The recognition that you can buy water means that somebody is not using all the water allocated in their concessions, otherwise why would they sell it (R#38).

Several respondents also voiced their concern about the activities of the unregulated water banks and the transference of volumes is being used to drill new wells in aquifers that were already being overexploited. They questioned the legitimacy of the water concessions and the transfer of volumes, and mentioned that the NWC does not monitor the existence of illegal wells, or that the volumes authorised in legitimate concessions are the ones that are being extracted (*Rule of law*). Many respondents explained that the information in the Public Registry of Water Concessions (PRWC) is inaccurate and/or unreliable (*Knowledge*), and this situation seems to be worsening due to the unregulated activities of the water banks. The following quote by a representative of municipal water services captures these diversity of responses:

> I have found many surprises in the PRWC… For example, there have been new subdivisions in residential areas [in the city], and we request from them [developers] a copy of the authorization of the National Water Commission for a certain volume of water, before we approve construction… The developers brought us a Groundwater Concession Certificate granted by the NWC… We then checked the concession number in the PRWC, and it turns out that the Certificate the developers gave us is already registered in the State of Nuevo Leon [almost a thousand kilometers away]… Someone had already made a transference of the Concession on the side, or something like that! How did this happen?… We don't know!... The people who do this transferences are so cunning that they are capable of much (R#17).

The assessment framework proposed in this study made it possible to identify that not having the mandatory Regulations (i.e., deficiencies in the *Rule of law*) is making it harder to have accurate information about groundwater (*Knowledge*), and making the management of groundwater resources more difficult; thus, resulting in a negative impact on water resources (*Integration*). In the case of the LChBC, this gap in key legislation could be making the problem of groundwater depletion even more complex and critical. Findings reveal that a gap in key legislation has translated into a lack of transparency, clarity, and credibility, and even results in doubts around the legacy of the governance process.

Many respondents also acknowledged that the absence of the mandatory Regulations of the 2004 NWL has created structural problems related to the authority and roles of RBOs and RBCs. The previous section discussed how the 2004 NWL gives more autonomy, new roles, and new powers to RBOs, and ways in which the decentralization of authority from the NWC headquarter to RBO has not taken place. A partial explanation lies in the 'legislation gap' (*Rule of law*) identified through the proposed framework. In repeated occasions, the 2004 NWL states that the authority of RBOs will be "established in this Law and its [mandatory] regulations". On occasion, this document makes reference to the Internal Regulations[29] of the NWC. Some certainty concerning the authority and responsibilities of officials overseeing different priority areas within the commission was provided within the Internal Regulations of the National Water Commission in 2006. While this helped narrow legislation gaps, some gaps continue to persist. This finding exposes the 'lack of transparency' (*Knowledge*) and accountability (*Rule of law*) in policy implementation. Several respondents were of the view that modifications to the structure, role and authority of the RBO have not been implemented, as echoed by the testimonial of a state water official indicated that:

> Apparently River Basin Organizations have new powers and new roles, they also have new job appointments and titles. [...] However, as time goes by it is becoming clear that not everything has been transferred to the RBOs …. There are still gray areas [in the legislation] that create confusion regarding who is responsible for what (R#25).

This finding shows that a gap in the regulatory framework has an impact on several aspects of a water governance system. In the case of the LChB, the lack of detailed

[29] Internal Regulations are official documents that also referred to as 'institutional structure documents' in the current study.

regulations created issues with water management activities such those related to water banks, as well as structural problems such as the ones with RBOs and RBCs. The 2004 NWL established guidelines for a new RBC structure, specifically for' Board of Governors. However the structure could not be implemented because there were not mandatory regulations established to do so. Because of this gap in key legislation, the LChBC had not been restructured to comply with the 2004 NWL. Consequently, the structure of the basin council during the fieldwork was the one established in the mandatory Regulations of the 1992 NWL, and in the BCOOR. The present study concludes that another constraint in the implementation of a viable water governance system in the Lerma-Chapala basin rests on not having the mandatory Regulations of the 2004 National Water Law.

6.6 Institutional roles and capacities for water management

The study findings suggest that the National Water Commission does not have the structures in place to fulfill its roles and enforce its authority effectively in the LChB. Findings show major discrepancies between what is established in official documents and what was happening in practice. This section discusses how the institutional structure of the NWC constrain the implementation of a viable water governance system in the LChB.

Literature suggests that it is important to match institutional roles with relevant authorities to ensure the proper functioning of water governance systems (WWAP, 2003; Solanes & Jouravlev, 2006; Batcheor, 2007). Having roles and responsibilities clearly defined and establishing systems of checks and balances brings transparency to water governance systems and allow for government officials and institutions to be held accountable for their actions, decisions and/or omissions (WWAP, 2003; Tortajada, 2010a; WGF, 2012).

The NWC is Mexico's sole water authority. According to Article 6 of the Internal Regulations of the NWC, the water authority is spatially organised in two levels (i.e., national and regional) with administrative units that are hierarchically subordinated to the Director General's Office of the NWC (SEMARNAT, 2006). RBOs and Local Management Offices are important pieces in the NWC's decentralization strategy (Wilder, 2010), as this structure is intended to allow the federal institution to be more responsive to local issues, thus complying with the subsidiarity principle (*Coherence*). Article 86 of the

2006 Internal Regulations of the NWC, articulates this point by listing the functions of Local Management Offices as follows:

> In support River Basin Organizations, Local Management Offices are to exercise its authority and its operational, executive, administrative and legal activities, with regards to integrated water resources management and the public goods under its care (SEMARNAT, 2006: Article 86, Section III).

The assessment framework proposed in this thesis was able to identify structural problems associated with the theme of 'insufficient operational capacities' (*Coherence*). Most respondents indicated that the NWC does not have enough staff at the local level to fulfill their duties around the supervision of infrastructure development, overseeing various programs, and enforcing various laws and pieces of legislation. Many respondents mentioned that the NWC has a very strong structure at the headquarters and a weak one at the local level. Evidence of these nationally strong and locally weak structures are captured in the following statement made by a NWC official:

> If you look at the structure of the River Basin Organizations, they are not the same as those in Headquarters. Headquarters have more areas to carry out their work. […] RBO do not have the strength and structure they have in Mexico City; and it is even worse at the Local Office… We have an Inverted Pyramid Structure! The Local Office is the one that has less personnel and has the weakest structure. Here [at the local office] many areas have been merged. The work that is carried out by two sub-directions at the RBO, is done here by only one (R#41).

The NWC's limited operational capacity was cited by water users and government officials as being the root cause of most water management problems such as water pollution, the existence of an unknown number of illegal wells, the drilling of new wells without concessions, and groundwater extraction without supervision among other issues. The following testimonial by a livestock water user reflects some of these concerns that were expressed by a variety of stakeholders:

> Not having enough staff is a big problem when it comes to enforcing the law […] The government has applied an irrational criteria to reduce its bureaucratic burden and they have cut it too thin. There is only little staff left and the National Water Commission has stopped doing acts of authority. They don't act as authority any more. They have no ability to operate and enforce their authority (R#9).

According to Sandoval (2004) and Castro (2006), budget restrictions and personnel cuts that occurred during the 1990s reduced the capacity of the federal authority to monitor, measure, regulate and manage water resources effectively. This pattern continued, and it was reported that the labour force of the NWC, which stood 38,188 employees in 1989

dropped to as low as 13,406 in 2008, with most layoffs taking place at the local level (CONAGUA, 2011a, 2014a). This provides further explanation for the NWC's limited operational capacity at the local scale. Respondents acknowledged that though the NWC has highly qualified staff, it is impossible for them to fulfill all their administrative, operative, and enforcement duties effectively due to its limited labour force. The following quote by a NWC official captures the diversity of responses in this context:

> Honestly, we do not have the human capacity for regulatory oversight… How many projects can you oversee when you have only one engineer and over fifty projects to supervise? We do not have the capacity to see if contractors or municipalities actually did what they told us they were going to do. We do not have the capacity to monitor and oversee... and supervising construction projects is not the only thing he does. We know exactly what we should be doing. However, we don't have enough staff to do it. We are trying our best [at the local level], but we need more staff to be successful (R#39).

Findings from implementing the proposed assessment framework led to the conclusion the 'insufficient operational capacities' (*Coherence*), the 'lack of law enforcement' (*Rule of law*), and the interaction of these themes and principles, represent major problems that have negatively impacted water resources management (i.e., water pollution and overexploitation of groundwater resources), the credibility of the NWC, and the establishment of a viable water governance system in the LChB.

This study also found disconnects between policy and practice regarding the role of the NWC. From the policy perspective, the literature encourages the avoidance of conditions in which management and regulatory roles are merged under a single authority, since that creates operational and credibility problems (Rogers & Hall, 2003; WWAP, 2006; Batchelor, 2007; Grigg, 2011). However, in practice the NWC is the sole water authority in Mexico and is responsible for development, management and regulatory activities associated with water resources. This condition is reflected in Article 9 of the 2004 NWL establishes that:

> The purpose of the National Water Commission is to exercise the powers conferred to the water authority and establish itself as the Federation's Governing Body with technical, regulatory and advisory status, in matters of integrated water resources management, including the administration, regulation, control and protection of the public water domain (DOF, 2004).

In this context, several respondents remarked that the NWC administers water resources, enforces the law, and sanctions those who do not comply with the law, and that this institutional structure has led to situations of abuse, corruption and negligence. Some

respondents indicated that water users are afraid to present complaints about irregularities or corruption, because they are fearful of potential reprisals, including the cancellation of their water concessions by the NWC (R#13, R#19, R#25, R#28, R#41). There were a few respondents who pointed out that the NWC is fulfilling the roles of 'judge, jury and executioner'; hence the feeling that credible systems of checks and balances had to be established. An excellent example of this discussion is provided by a NWC official who remarked that:

> The National Water Commission is playing the role of judge and jury. […] No, I don't think that there is any interest nor vision to change the structure of the institution... The NWC's failure to act, or to do as little as possible, is because there is no one forcefully demanding us [NWC] to change… The NWC is not enforcing the law, and until someone comes and demands that we change and enforce the law, we are going to continue as we are: laying low, taking it easy, without hassle (R#42).

Findings from implementing the framework further revealed that most respondents are concerned about 'inadequate institutional structures' (*Rule of law*) that often stem from the sole water authority having contradictory roles. For example, the same authorities hold administrative and enforcement roles. Accordingly, study respondents alluded to the fact that this results in 'insufficient operational capacities' (i.e., the lack of *Coherence*) particularly at the local level. The interaction of these principles and associated themes are in part responsible for the slow progress towards improving water management in the LChB, as manifested in the prevalence of problems such as the overexploitation of groundwater resources, the pollution levels in rivers and lakes, and the conflicts for over-allocated surface water resources. This study concludes that a constraint in the implementation of a viable water governance system in the Lerma-Chapala basin is directly linked to deficiencies in the structure of the National Water Commission.

6.7 Water allocation mechanisms in the Lerma-Chapala Basin Council

A major accomplishment in the LChBC has been the successful negotiation of a treaty for the allocation of scarce water resources. Findings disclose that stakeholders successfully engaged in a deliberative decision-making process that resulted in this treaty. Legally binding agreements such as water resource allocation treaties represent an important aspect of water governance regulatory frameworks that reduce arbitrary decisions and actions, help mitigate conflicts, and provide legitimacy, clarity, transparency and credibility to the water governance process (Rogers & Hall, 2003; WWAP, 2006,

2015). Mexico's official water management documents recognize the relevance of including water users in negotiations to reach widely acceptable solutions to water management problems. Article 13bis 4 of the 2004 NWL provides a good example in this regard.

> In conformity with this Law and its regulations, the National Water Commission, through River Basin Organizations and within the scope of River Basin Councils, will consult with water users and civil social organizations to solve potential temporary limitations to existing water rights, in order to cope with emergencies, extreme scarcity, hydrological imbalance, overexploitation, [water] reserves, pollution, and risk, or when the sustainability of vital ecosystems is compromised; by the same token, [the NWC] will solve the limitations arising from the existence or declaration and implementation of regulated zones, reserve zones and prohibition zones. In these cases, domestic and municipal water uses will have priority [over other uses] (DOF, 2004: Article 13bis 4).

Findings in this thesis reveal that the 2004 Surface Water Allocation Agreement was praised by several respondents as the greatest achievement of the Lerma-Chapala Basin Council. A common reflection was expressed by a NWC official when he said, "the [surface water] Allocation Agreement […] took a lot of work and time, but it is a great achievement" (R#43). Similarly, participants made it clear that this is the only case where negotiations and decisions pertaining an important conflict have been made in the LChBC, and in particular within the 'Arrangement and Allocation Workgroup' (Figure 3.8). In contrast to the constraints already discussed in this chapter, this achievement complies with what is established in Mexico's water policy (i.e., Article 13bis 4 of the 2004 NWL). This reflects a good example of successful policy-practice connection. Hence, this study acknowledges the 2004 Surface Water Allocation Agreement as a major achievement.

The main conflict in the LChB is the allocation of surface water, which resulted into the signing of the 1991 'Agreement on Availability, Distribution and Water Uses' by government representatives from the five states in the basin and the National Water Commission without the participation of water users. But this agreement proved to be inadequate in mitigating conflicts, evident in the continuous decline of lake water levels during the second Lake Chapala Crisis (1994-2003), leading to a revision of the treaty (Wester *et al.*, 2008). Participants in the present study indicated that water users, state government and NWC officials participated and contributed as equals in negotiations that took approximately two years before reaching this landmark agreement which a state water official acknowledged as "the first time we [multiple stakeholders] witnessed this level of

water user involvement in decision making in the [Lerma-Chapala] basin and in Mexico as a whole" (R#25). The present study suggests that this allocation agreement marks a successful step in water management decision-making within the LChB, which is notably different from the previous state-centred top-down approach (i.e., *pre-Rio context*). This success was likely driven by the Lake Chapala crisis between 1994 and 2003, which likely acted as a wakeup call for all stakeholders.

While the agreement was successful, some respondents still pointed out some disagreements that emerged in the negotiations, the most significant of which concerned determining which mathematical model that was most appropriate for determining surface water allocation in the basin. In this context, the federal government and the State of Guanajuato presented two conflicting models, each arguing that their model was more relevant based on the local context. After heated discussions and debates, the federal model ended up being used. The established agreement details the technical elements that guide the allocation of surface water for competing uses along the basin, and sets up minimum volumes that should remain in the reservoirs to guarantee the supply of authorized water concession while reducing the risk of floods. It was described as a complex negotiation because the agreement attempts to provide security to water users while at the same time, limiting their rights to avoid water over-allocation during times of drought. Results indicate that there exists an orderly allocation of surface water to each state through the establishment of mutually agreed rules that bring transparency into the water governance process and aid in mitigating potential stakeholder conflicts and conflicts between states (specifically, the states of Jalisco and Guanajuato), especially during periods of drought. In this context, a state water official made the following statement:

> It was a very long process. […] Discussions and negotiations revolved around two different mathematical models. One model was put forward by the Mexican Institute of Water Technology and the other one by the State Water Commission of Guanajuato. […] There were many people involved and the negotiations that took two years. Both sides brought in experts to explain their models and no question went unanswered. In the end, the decision was to use the model proposed by the National Water Commission and the Mexican Institute of Water Technology. Guanajuato was not very happy… But, Hey! That's the thing about democracy, you don't always get your way (R#24).

The impact of the 2004 Surface Water Allocation Agreement on water governance is significant. This is because it provides an empirical example that a viable water governance process can be implemented in the LChBC.

Wester, Vargas-Velazques, Mollard and Silva-Ochoa (2008) have acknowledged the complexity of surface water allocation in the LChB and confirm the above mentioned finding that the 2004 Surface Water Allocation Agreement was product of a series of negotiations that lasted years, which involved the active participation of the five states in the basin, the National Water Commission, and water user representatives. However, their study differs from this thesis because their analysis focused on negotiation processes in the context of surface water allocation through a descriptive approach. They also acknowledge that the LChB is in a complicated transition from a centralized to a multi-stakeholder approach to water management. This research builds on their study by emphasising that the decision-making process that resulted in the 2004 agreement marked a new approach to decision making manifested in a policy successfully translating into practice within Mexico's water policy environment. As well, this approach indicates some progress in the transition from a state-centred top-down model (i.e., *pre-Rio context*) to a water governance-based approach (i.e., *post-Rio context*) to water management. Wester and colleagues provide valuable research that focuses on the difficulties of renegotiating water allocation in overcommitted basins, especially when attempting to secure environmental flows. Hence, this thesis considers it important to emphasise this achievement in response to Biswas' and Tortajada's (2010) call for examples of good practice in water governance and IWRM within jurisdictions aiming to make progress.

6.8 Final Remarks

The framework presented in this thesis resulted in the identification of several themes that relate to the way water is governed in the LChB. It also made it possible to identify strengths and constraints in the assessed water governance, even in cases where multiple principles within the framework were intertwined in complex ways. The strengths and constraints presented here have the potential to enhance or limit the viability of any water governance system.

A major benefit of this framework rests in the simplicity of the five core principles that were utilized. This refinement made it possible to compare guiding principles in existing policies and official documents to the practice of water governance on the ground within the LChB. A clear finding that emanates from the analysis is the existence of major disconnects between existing policies and the actual practice of water management. Thus,

while policy documents reflect a shift from a state-centred top-down approach to a water governance-based model, interviews reveal that the opposite is happening in the Lerma-Chapala basin. The testimonials of two federal officials, from the National Water Commission and the Ministry of the Environment and Natural Resources, provide a contextual summary of these findings:

> I can see fear in the National Water Commission. Fear to lose control to some extent… to lose Power. [...] I do not think we [the NWC] have overcome that part yet... That fear has not been surpassed. However, I think we are seeing a little less than before. […] I am not saying that public participation is not taking place, but it is necessary that participation be more effective. But, there is still some fear remaining within the NWC: 'And if we lose control?' [They ask themselves.] I believe that we are headed to a real aperture of the Basin Council and decisions will start to be made there, and we will leave behind meetings in dark corners (R#41).

> Evidently there is a lack of a participatory culture in Mexico… in the general population. And there is no culture of delegating tasks, at all levels of government. There is an inexplicable fear to let others participate in water management. I do not know why… There is a lot of fear of losing power... There is much fear. Exaggerated fear. But I think it has a lot to do with the issue of political parties and the political system [in Mexico]. […] I think we have to review all that… All that is influencing water governance (R # 49).

It is noteworthy that a benefit of the proposed framework also lies in the breath of issues that were unearthed around water policy, planning and management in the LChB. The scope of these issues transcends the current thesis. Therefore, a summary of the findings discussed in this Chapter are outlined in Table 6.1. The table also shows the interplay of various water governance principles, demonstrating the multifaceted nature of water governance. Because of the broad scope of issues that emerged from the analysis, not all micro-level details are captured in this discussion. A more comprehensive documentation of the broad range of themes that were discussed by respondents are captured in Appendix VII.

Table 6.1: Summary of findings by water governance principles and themes

Principle	Context	Theme	Constraints FWUR[1]	FSUA[2]	DMRC[3]	NHMR[4]	SNWC[5]	Achievement SWAA[6]
Participation	Post-Rio	Participation in multilateral decision-making forums	I			D		I
		Multiple stakeholder engagement	I					I
	Pre-Rio	Little participation / governments make decisions	I		I			
		Questionable water user's representation	I					
Coherence	Post-Rio	Collaboration and coordination		D, I				
		Decentralization to the lowest viable level	D		D, I			I
		Operational capacities						
	Pre-Rio	Fragmentation and sectorization	I	I	I			
		Centralized decision making			I	I		
		Insufficient operational capacities					I	
Rule of Law	Post-Rio	Comprehensive rules and regulations	D			D		D
		Institutional structures for water management	D		D	D	D	D, I
		Law enforcement						
	Pre-Rio	Legislation gaps and overlaps	I			I		
		Inadequate institutional structures	I		I		I	
		Little law enforcement			I	I	I	
Knowledge	Post-Rio	Information systems						I
		Education						I
		Dialogue and negotiation				D		I
	Pre-Rio	Inefficient information systems		I		I		
		Insufficient education	I	I				
		Lack of transparency	I	I	I	I		
Integration	Post-Rio	Basin planning and management			D			I
		Sustainability and Conservation						
	Pre-Rio	Regional development planning and management		I	I			
		Negative environmental impacts				I	I	

[1] (FWUR) Failure of water user representatives to advance issues that pertain to their stakeholder group in the Lerma-Chapala Basin Council.
[2] (FSUA) A fragmented, sectoral and uncoordinated approach to water management that limits the potential impact of programs and activities that are being implemented in the Lerma-Chapala basin.
[3] (DMRC) Decision making remains centralized and does not consider local context.
[4] (NHMR) Not having the mandatory Regulations of the 2004 National Water Law creates a significant gap in Mexico's water legislation.
[5] (SNWC) Deficiencies in the structure of the National Water Commission is restraining its capacity to function efficiently.
[6] (SWAA) 2004 Surface Water Allocation Agreement.
(D) Findings from official document analysis.
(I) Findings from interview analysis.

Chapter Seven

7 Conclusions

This chapter concludes the dissertation by providing a summary of major findings. It also discusses the conceptual and practical contributions of the thesis, proposes some directions future research, and provides recommendations to improve water governance and management practices in the Lerma-Chapala basin.

7.1 Summary of findings

This thesis commenced by acknowledging the challenges that emerge when addressing water governance. Specifically, it pointed out the lack of a strong consensus on a single definition of the concept of water governance itself (Biswas & Tortajada, 2010; Varis *et al*., 2014). Following an in-depth review of water governance and management literature, the current study also found that there exist no standard framework for assessing the effectiveness of water governance systems. Thus, while a wide range of frameworks have been used to assess various aspects of water governance, the disparate nature of these frameworks makes it difficult to compare study findings or holistically understand how multiple factors impact water governance systems.

To address these complexities, this dissertation sought to find common ground and consolidate various frameworks into a holistic but simplified framework that could be applied to assess water governance systems, strengthen debates on water governance and holistically value spatial and temporal variations in water governance. Drawing insights from existing literature the study developed a framework with five core water governance principles (i.e., *Participation, Coherence, Rule of law*, *Knowledge* and *Integration*). The proposed framework was then tested by applying it in a content analysis of water-based policy and planning documents in Mexico and interviews with various stakeholders in Mexico's Lerma-Chapala basin. Finally, findings from the document analysis and interviews were compared to understand the extent to which existing policies around water manifest themselves in practice.

Overall, the study finds that, while a drastic evolution in water policy from more to-down to a bottom-up approach can be observed, the practice of water governance within

the LChB largely remains centralized, hierarchic and state-centred. Thus, at best, a participatory water governance approach for the most part exists in theory.

First objective: *To develop a water governance assessment framework by refining normative attributes that best conceptualize water governance in the existing research literature.*

This thesis determined that the abundance of water governance principles offered in the literature represents a challenge for researchers. However, this dissertation finds that some of these principles have overlapping meanings; hence the attempt to reduce the existing set of principles into a refined, simplified and holistic group that is suitable for assessing water governance in multiple contexts. The refinement process resulted in five key principles: *participation, coherence, rule of law, knowledge* and *integration.* These principles represent structures that are required for a water governance system to function effectively.

Following the application of the proposed framework to the case of the Lerma-Chapala basin in Mexico, this thesis finds it allows for a better conceptualization and makes it easier to cluster related topics into related themes that allow for effective analysis and the comparison of multiple data sources. In this case, interviews and policy documents were analyzed to reveal connections between policy and practice in water governance. Because of the holistic nature of the developed framework and its effectiveness, it could be applied to compare conditions across multiple scales (e.g., local, national and international) and monitor the evolution of water governance over time. The proposed framework could also be applied to a critical literature review, as it captures multiple contexts within which issues of water governance could emerge. In a nutshell, the framework proposed in this dissertation effectively serves the purpose for which it was developed.

Of note is the ability of the developed framework to capture the interplay among water governance principles and their associated themes. This made it possible to identify constraints and achievements (see Table 6.1) associated with water governance in the LChB, which leads the current dissertation to conclude that the proposed framework serves the purpose of identifying needed changes within water governance systems. However, this interplay also reveals a potential shortcoming in the framework, as it does not clearly differentiate between water governance and management. For example, issues related to

water management such as water pollution or groundwater overexploitation, could be the result of lack of enforcement or a gap in legislation, which are more closely related to water governance. Thus, gaining detailed understanding would require an in-depth analysis of management and governance issues and their interactions. In this context, the present study agrees with Tortajada (2010a) that describes water governance and water management as being interdependent, but it also agrees with Mitchell (2013) regarding the need for more research to understand the interaction between these two concepts.

Second objective: *Apply the developed water governance assessment framework to official water policy documents with the aim of understanding pre-/post-Rio water governance transitions in Mexico.*

The proposed framework was applied to existing water related policy and planning documents in Mexico. This analysis confirmed a transition from a state-centred top-down approach to a water governance-based mode to a more participatory approach, which was evident in the orientation of various policy documents. These shifts have been partially identified by several studies on water policy in Mexico (see González-Villarreal & Garduño, 1994; Dourojeanni, 2001; Mestre, 2001; Wester *et al*., 2009b; Wilder, 2010). Hence, the ability to expose these shifts using the proposed framework adds more credibility to its effectiveness. The observed trends led this dissertation to conclude that there have been significant shifts in water management paradigms in Mexico since 1992. This is evident in the noticeable increase in the use of water governance-based terminology in official documents. These terminologies were classified using the five principles in the proposed framework.

The pattern resulting from applying the proposed framework to official documents suggest that Mexico did not follow an evolutionary pattern that progressed through years (or even decades) of engagement to achieve policies for integrated water resources management. Finding reveal a noticeable change over a short period of time, which was driven by a top-down approach. Wilder (2010) explains that Mexico was under pressure to modernize its water policy framework during the negotiations of the North American Free Trade Agreement (NAFTA), in 1992. Also, Buchenau (2008) mentions that President Salinas (1988-1994) considered NAFTA a key piece in his neoliberal economic strategy, and the crowning achievement of his administration. Consequently, it is likely that in 1992

President Salinas was highly motivated to approve a new water law, which complied with the requirements of the NAFTA negotiations, while embracing IWRM as a new paradigm for solving water resource management and governance issues in Mexico.

Findings also show that significant changes in the institutional structures of the Ministry of Agriculture and Hydraulic Resources (MAHR) took place after the creation of the National Water Commission in 1989 (SARH, 1989), and the publication of the NWL in December 1992 (SARH, 1993). However, it was not until 1996 that the NWC created mechanisms aimed at facilitating inclusive water user participation within its structure. It also needs to be considered that the political and economic context in Mexico changed radically between 1993 and 1996. For example, Mexico experienced a major financial crisis in December 1994, a few weeks into a new presidential administration (i.e., Ernesto Zedillo, 1994-2000), and consequently, Mexico had to comply with the "good governance" and IWRM requirements placed by the International Monetary Fund and the World Bank in order to gain access to funds that would help work its way out of the crisis (Hamnett, 2006; Wider & Romero Lankao, 2006; Wilder, 2010).

This suggests a strong pressure on Mexico's political officials to implement water governance reforms, which in part explains the creation of the Coordination of River Basin Councils within the structure of the NWC and the reforms to Article 15 of the RNWL in 1997, which allows water users to participate in equal numbers as government representatives in the LChBC (DOF, 1997). Therefore, findings also suggest a level of reluctance of the politicians in fully implementing water governance reforms, possibly because it represented a revolutionary change in the *status quo.* It is noteworthy that the outcomes of this policy analysis were compared to interview data to understand how these changes to political structures impacted water governance on the ground.

Third objective: *Apply the developed water governance assessment framework to stakeholder interviews to understand the state of water governance in the Lerma-Chapala basin, and how these conditions relate to policy and the overall creation of a viable IWRM process.*

The implementation of the proposed framework to the LChB made it possible to identify discordances between the formal and informal systems. For example, informal practices such as the clientelistic and paternalistic attitudes rooted in Mexico's socio-

political context stem from state-centred top-down system that prevailed in Mexico for several decades. These problematic practices have resulted in the existence of: (1) government officials who do not value stakeholder engagement and participation in decision making processes, and (2) water users who are not used to being engaged with government officials and other stakeholders in decision making. These deeply rooted traditional structures are limiting the implementation of water governance policies. The application of the framework also allowed for the identification of operational gaps in the Lerma-Chapala basin regarding the implementation of laws and policies. The persistence of a silo approach to water governance and management, which is a remnant from the previous social order, reflects the lack of multi-stakeholder coordination and engagement.

Further, the interview findings reveal that in 2008 the NWC did not have enough staff on the ground to fulfill their duties pertaining to supervision, oversight and enforcement, which were described as having ripple effects on pollution and overexploitation of water resources because of porous law enforcement. In this context, findings show that the implementation of neoliberal national policies drastically reduced federal water bureaucracies (Sandoval, 2004; Castro, 2006; Wider & Romero Lankao, 2006). However, a by-product of these policies was the emergence of operational problems for the NWC at the local level. The concurrent analysis of official document and interviews depict the discordance between what ought to be happening (according to laws and policies) and what was happening on the ground (based on key informant testimonials).

However, findings reveal that some progress has been achieved in the implementation of water governance. For example, the 2004 Surface Water Allocation Agreement demonstrates the viability of implementing a multi-stakeholder decision-making process to reach agreements that mitigate conflicts and solve sensitive issues in the LChB. The proposed framework made it possible to identify progress in the implementation of water governance principles in the basin, and it would be a mistake to dismiss this progress as something without significance, because though minimal, they mark a step forward in the implementation of a viable water governance system in the basin. Based on these interviews with stakeholders who are directly engaged in water use, management and governance, the current thesis concludes that progress in water governance and IWRM has been slow, with much more work remaining to be done.

7.2 Contributions of the study

7.2.1 Conceptual contributions

The most significant conceptual contribution of this research, which adds to the existing literature, lies in the creation of a holistic water governance assessment framework. This research refines seventeen dominant water governance principles in the existing literature among other themes and contextually consolidates them into five coherent and well defined principles. These five core water governance principles were applied in the current study to textual and interview data to gain an understanding of water governance within the Lerma-Chapala basin of Mexico. The framework proposed here represents a consolidation of at least fourteen years of constantly evolving water governance principles. The successful application of these principles to compare interviews and policy documents and reveal policy-practice disconnects provides evidence for the effectiveness of the developed framework. Because the principles consolidate varying ideas in the literature, it is also an all-encompassing framework that could be utilized for systematic literature reviews and the assessment of spatio-temporal variations in water governance in various jurisdictions.

Studies like Van Leeuwen and Sjerps (2016), Van Leeuwen and Sjerps (2015), Hurlbert and Diaz (2013), Oliveira *et al* (2012), da Costa Silva (2011), Engle and Lemos (2010), and Lautze *et al* (2011), address some conceptual aspects of water governance, but they focus on three or four principles (included in the seventeen principles offered in the literature) and thus, do not paint a full picture of the range of principles that could be assessed. This dissertation addresses the need to reconceptualise principles by proposing a refined set and meanings of water governance principles; thus, creating opportunities for researchers that ensure they (1) avoid repeating similar or related principles in their work, (2) identify themes that stem from the data relating to water governance and understand how various aspects of water governance are interrelated, and (3) identify strengths and constraints of water governance systems, using their functionality as the main criterion.

A second conceptual contribution of the thesis resides in better definition of hierarchic concepts pertaining to water governance. Subordinated to the concept of the five principles described above, this thesis proposes a series of themes (Table 5.1). These themes encapsulate indicators that emerged from the data. More specifically, this thesis

contributes to the understanding of how these themes interplay and outlines to determine the viability of water governance systems. Understanding this interplay is becoming crucial because of increasing water demands and potential conflicts. These concerns are addressed in this thesis by identifying the implementation gap through the concurrent analysis of official documents and interviews, which point towards strengths and opportunities for improvement in a specific water governance system. It is noteworthy that, despite using only five principles, the proposed framework is not opposed to emergence of new themes. The framework presented in this thesis is not set in stone, but rather, marks a new move towards the creation of an all-encompassing framework for assessing water governance.

7.2.2 Methodological contributions

The current study demonstrates the value of content analysis in testing newly developed frameworks. In the context of the current study, a water governance framework was developed by integrating ideas from multiple clusters of literature on water governance and management. Content analysis requires the development of an analytical codebook with well-defined themes to help guide the coding (Krippendorff, 2013). In the context of this thesis, the methodology therefore added more rigor to the development of the framework by requiring the researcher to come up with well-defined principles that could be superimposed on the data. The content analysis also made it possible to superimpose the five principles on the interviews and policy documents to understand water governance within specific geographical contexts. Due to the structured nature of the analysis, it was possible to compare the practice of governance based on stakeholder interviews to existing water governance policies. Although studies of water governance have used content analysis (e.g., Gillet *et al.*, 2014; Kuzdas *et al.*, 2015), the current study specifically highlights the value of the methodology for creating a well structure framework, testing the framework on different clusters of data and comparing outcomes in different data sources to understand how water governance policies manifest in practice.

Since content analysis of documents and interviews has been applied in studies on water governance (Baumgartne & Pahl-Wostl, 2013; Grecksch, 2015), the current study is a confirmation that the methodology is indeed useful for the study of water governance, which is often multifaceted and complicated. It reveals the value of the methodology in capturing broad themes pertaining to water governance, organizing them under specific

clusters (i.e., principles) and quantifying their prominence to tease out the most recurrent topics across different clusters of data. For example, the quantification of key topics in water policy documents and stakeholder interviews made it possible to visualize these trends through graphs and visually compare the prominence of different themes.

This thesis advances the understanding of the relationship between formal and informal systems in water governance. For example, interinstitutional collaboration and the coordination of efforts is formally established in Mexico's water policies. However, progress in the establishment of collaboration networks is slow because of informal structures such as sectoral inertias that remain in institutional memory. Research has been conducted on institutional fragmentation (Edelenbos and Van Meerkerk; 2015), the impacts of water reforms on local contexts (Olivieira *et al.*, 2012; Hornidge *et al.,* 2013; Mapedza *et al.,* 2016; Rola *et al.,* 2016), networks (Kuzdas *et al.,* 2015), conflict and cooperation (Funder *et al*., 2010) and legitimacy (Wood, 2015) in an attempt to further understanding of the relationships between formal and informal systems. This thesis builds on research in this domain by confirming the importance of considering local context when developing water policy reforms, and shows that local context has the capacity to support or restrain the implementation of water governance.

7.2.3 Recommendations for policy and practice

Based on the development and application of a framework for assessing water governance, the current study was able to identify multiple situations where local knowledge provided potential solutions for addressing common problems at the basin level. It is noteworthy to emphasise that there is no quick fix or single solution to improve water governance in the Lerma-Chapala basin, and that any improvements in the water governance system will require time, dedication and ongoing adjustments. As observed in the water governance literature, the establishment of a viable water governance system is not a one-time event, but rather a long evolutionary process.

Based on the study findings, three major recommendations that emerged from key informants' perspectives on improving water governance in the Lerma-Chapala basin are discussed. Though the complexity of the issues that emerge reveal that a lot of work remains, this section attempts to recommend some practical actions that could potentially

enhance the experience of water governance and management in the LChB. These three suggested mechanisms for improving water governance in LChB are discussed as follows:

1. *The federal government should provide integrated water resource management training and education programs at all levels through the River Basin Council's structures.*

It is imperative to change the mentality of government officials and water users to facilitate the transition from a traditional state-centred top-down practices, to a more water governance-based approaches. People should be aware of the importance of having the basin as a management unit and informed of the problems that exist in their basin, with an emphasis on the ones present in their sub- and micro-basin (i.e., local scale). As revealed in the current study, the most significant changes in water governance occurred when the LChB underwent some of its greatest challenges. People need to become familiar with the problems and potential solutions to water-related problems at the local and basin levels. They also have to become more aware of what is at stake if they fail to play part in water governance forums. It is necessary to make water users and the general public aware that there is a basin council with established frameworks (i.e., Auxiliary Organizations) for them to be participate in decision making and in the implementation of collaborative measures to achieve common goals. They also need to know that there are water user representatives in the Lerma-Chapala Basin Council who are to voice their concerns, as well as the mechanisms through which they can participate in the election of their representatives. Overall, the education and empowerment of water users could potentially result in water users demanding more accountability from their representatives.

Training and education on integrated water resource management at all levels of the basin, should also be required for all NWC officials (headquarters, RBOs and Local Management Offices) to help facilitate cultural change. This is necessary because existing traditional structures are deeply engrained in the practice of water governance and management. As such, transformative education is needed to help stakeholders rethink their approaches. Loucks (2000:5) observes that "changing the social and institutional components of water resource management systems is often the most challenging because this involves changing the way individuals think and act". Much work and political will is required to implement a viable water governance process in the Lerma-Chapala basin. In

this regard, Biswas and Tortajada (2010a) provide an example of the transformation of the institutional culture.

A major finding of the current study is the existence of fractures in stakeholder coordination and collaboration. An additional recommendation is to carry out educational programs that bring together multiple stakeholders in forums (i.e., Auxiliary Organizations) where their role and responsibilities can be discussed in-depth, and where stakeholders can brainstorm about problems and potential solutions, while attempting to come up with management plans for the sub- or micro-basin, or aquifer, and establish legally binding agreements on collaborative activities. This actions would ensure that legal frameworks for collaboration are established at the local level and minimize arbitrary or poorly coordinated decision making. Without this mechanisms in place, existing fractures will likely remain persistent.

2. Strengthen water user participation and representation in the LChBC.

The federal and state governments have to support user participation and help water users in the establishment and consolidation of civil social organizations (i.e., Sub-basin Commissions, Micro-basin Committees, and COTAS). It is necessary to let stakeholders participate in planning, implementation and management of water resources at all scales (i.e., aquifer, sub- and micro-basin, and river basin). This will contribute to the establishment of a more viable water governance system. Representation can be strengthened through the formation of Auxiliary Organizations at different levels, which could provide the opportunity for various representatives (e.g., representatives from aquifers, sub- and micro-basins) to be part of the election process for water user Board Members to the LChBC. Building communication and collaboration networks between Auxiliary Organizations could help provide more rigorous and balanced solutions to problems identified by stakeholders at the local level. This could also aid in informing water users and the population within the basin about the activities of the basin council, and how the council copes with the problems that are brought forward. If user participation is equally supported in all states, it will be possible to improve the democratic process. Several researchers have provided examples in multiple contexts were these kinds of informed participation are that are lacking in the LChB have yielded positive transformative results

(for examples, see Norman *et al.*, 2013; Gallego-Ayala and Juizo, 2014; and Dell'Angelo *et al.*, 2016).

3. *Strengthen legislative and administrative frameworks to improve water governance systems.*

Findings in the present study revealed that the mandatory Regulations to the 2004 National Water Law have not been enacted, and consequently, the 2004 NWL cannot be fully applied. They disclose management and structural issues such unregulated water banks, and uncertainty in the roles and authority of RBOs and RBCs, due to the lack of detailed regulations that define how the system should work as a whole, and who should do what and to what extent. Thus the rule of law cannot be established effectively when key legislation is lacking. Consequently, it is imperative that this legal gap be closed.

Findings also show that it is imperative that agencies and organizations have staff who are well trained, appropriately equipped and sufficient in numbers to carry out their assigned duties effectively, especially at the local scale. A strong legislative and administrative framework is considered in the literature as a cornerstone in the implementation of an effective water governance system; however, the capacity to enforce the law is also an important factor in the successful implementation of the rule of law. Therefore, this thesis recommends that the operational capacities of water related institutions and organizations, especially concerning enforcement duties be strengthened particularly at the local scale. The reasoning behind this recommendation are well echoed in state water official's claims as follows: "what is the point of having the best law in the world is you are not going to enforce it" (R#29). Laws that are not enforced become dead letters.

Another major recommendation of this thesis is that the administrative and law enforcement activities around water should be carried out by different institutions. According to the National Water Law, the National Water Commission is not only responsible for implementing administrative and normative functions of water governance. It is also responsible for enforcing and interpreting the NWL and its regulations, and for applying sanctions regarding water. To avoid a conflict of interest it is necessary to separate the administrative and normative functions from enforcement and sanctioning ones. This could be done by separating these functions into two independent institutions. Mexico has

experience in this regard. In 1996 Mexico's federal government separated the administrative functions in the forestry and fishery sectors and place them under the newly created Ministry of the Environment, Natural Resources and Fisheries, while placing the enforcement functions under the Federal Attorney's Office for Environmental Protection. These separation of functions and powers also establishes a system of checks and balances, as the activities of one agency requires the other one to function effectively. This success has, to a large extent, been achieved in Mexico's forestry and fisheries sectors should serve as a useful lesson for the governance of water.

Finally, a major area of deficiency in governing Mexico's water lies in the lack of state-funded research that monitors the system and provides evidence-based insights on existing deficiencies and potential improvements. For example the framework developed in the current study could be applied to monitor systemic and practical aspects of water governance in the LChB and help identify deficiencies on a variety of themes, including stakeholder relations, policy and planning, and water management practices on the ground. As such, this thesis strongly recommends the establishment of a third-party research body responsible for monitoring policy and practice in governance and use of water resources over time and provide feedback on potential improvements that could be made.

7.3 Study limitations

The current study is not without its limitations. The first limitation is that this research focuses on the basin level and does not apply the water governance assessment framework to smaller scales (i.e., sub-basin, micro-basin, or aquifer levels). Not all challenges and strengths can be observed at a large scale; consequently, the assessment of water governance could be improved by including smaller scales in such studies. Additionally, this thesis does not focus comprehensively on Auxiliary Organizations, the interplay among these organizations and the basin council. All these factors constitute key aspects of water governance systems that were beyond the scope of the current study. However, such analysis would have yielded more detailed results on the practice of water governance on the ground. Applying the assessment framework to these subsidiary organizations could provide further insight on themes, constraints, achievements and opportunities that could together contribute to improvements in the water governance system of the Lerma-Chapala basin.

A second limitation concerns language differences acknowledged earlier. This limitation was minimised by working in the source language (i.e., Spanish) for as long as possible (Van Nes *et al.*, 2010), which proved to be useful by helping the researcher preserve original meaning to the full extent possible. Nonetheless, the translation of quotes proved to be challenging, as it was often difficult to find English words that perfectly depicted what the texts and/or respondents were saying. Although the researcher sought to preserve original meanings in the translation process, it is worth noting that literal translations from one language to another (i.e., Spanish to English) may not always be very clear (Van Nes *et al.*, 2010). To avoid confusion, some grammatical corrections were made to literal translations to make readings in English easier, while maintaining original meanings to the best extent possible.

7.4 Directions for future research

There are at least three directions for future research that emerge from this thesis. First, future research could further test the water governance assessment framework in different basins in Mexico and in other jurisdictions. Research should also be carried out at various scales, including lower tier governance forums (i.e., Auxiliary Organizations) using the same assessment framework. It is desirable to study vertical and horizontal interactions among water governance forums at various scales.

A second direction for future research involves international development and financial institutions. Most, if not all the constraints identified by this study are associated with the 'good governance' principles used by international financial institutions who significantly impacted Mexico's water governance trajectory. Having a strong legal and administrative framework, decentralization policies, public participation in decision making, and the sustainability of natural resources (including water), are all part of the preconditions imposed by international financial institutions to client nations who desire funding. Consequently, future research could seek to answer the following questions: "Why do international financial institutions fail to put more pressure on governments to fulfill funding preconditions?", "Why do international financial institutions continue to provide funding to countries that partially implement structural adjustment programs?", "How are international financial institutions assessing progress in the implementation of structural adjustment programs?"

A final direction for future research would be to focus on the impact of bureaucracies in the implementation of reform processes and their outcome. Constraints identified in this research indicate that the Mexican water bureaucracy plays an important role with regards to the pace by which reforms are implemented. Changes that threaten the prevailing *status quo* are often met with different levels of resistance from the ruling bureaucracy, and may result on an unnecessarily long and slow process. Outcomes of the study also indicate that this very long transition from one water management paradigm to the next has not solved the serious management related problems that were present in the basin since the 1980s. New research is beginning to address such issues. The current study encourages more research in this regard.

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Appendix I: Research Ethics Approval

Office of Research Ethics

The University of Western Ontario
Room 00045 Dental Sciences Building, London, ON, Canada N6A 5C1
Telephone: (519) 661-3036 Fax: (519) 850-2466 Email: ethics@uwo.ca
Website: www.uwo.ca/research/ethics

Use of Human Subjects - Ethics Approval Notice

Principal Investigator: Dr. D. Shrubsole
Review Number: **15224S** **Review Level:** Full Board
Review Date: June 13, 2008
Protocol Title: A Shift from Government to Governance: Integrated Water Resources Management in the Lerma-Chapala Basin, Mexico
Department and Institution: Geography, University of Western Ontario
Sponsor:
Ethics Approval Date: June 25, 2008 **Expiry Date:** December 31, 2009
Documents Reviewed and Approved: UWO Protocol, Letter of Information.
Documents Received for Information:

This is to notify you that The University of Western Ontario Research Ethics Board for Non-Medical Research Involving Human Subjects (NMREB) which is organized and operates according to the Tri-Council Policy Statement: Ethical Conduct of Research Involving Humans and the applicable laws and regulations of Ontario has granted approval to the above named research study on the approval date noted above.

This approval shall remain valid until the expiry date noted above assuming timely and acceptable responses to the NMREB's periodic requests for surveillance and monitoring information. If you require an updated approval notice prior to that time you must request it using the UWO Updated Approval Request Form.

During the course of the research, no deviations from, or changes to, the study or consent form may be initiated without prior written approval from the NMREB except when necessary to eliminate immediate hazards to the subject or when the change(s) involve only logistical or administrative aspects of the study (e.g. change of monitor, telephone number). Expedited review of minor change(s) in ongoing studies will be considered. Subjects must receive a copy of the signed information/consent documentation.

Investigators must promptly also report to the NMREB:

a) changes increasing the risk to the participant(s) and/or affecting significantly the conduct of the study;
b) all adverse and unexpected experiences or events that are both serious and unexpected;
c) new information that may adversely affect the safety of the subjects or the conduct of the study.

If these changes/adverse events require a change to the information/consent documentation, and/or recruitment advertisement, the newly revised information/consent documentation, and/or advertisement, must be submitted to this office for approval.

Members of the NMREB who are named as investigators in research studies, or declare a conflict of interest, do not participate in discussion related to, nor vote on, such studies when they are presented to the NMREB.

[redacted]

Chair of NMREB: Dr. Jerry Paquette

Ethics Officer to Contact for Further Information			
☑ Grace Kelly [redacted]	☐ Janice Sutherland [redacted]	☐ Elizabeth Wambolt [redacted]	☐ Denise Grafton [redacted]

This is an official document. Please retain the original in your files.

cc: ORE File

Appendix II: Water governance principles defined by researchers

Water governance principles defined by researchers

Proposed Meta-principle Participation

Principle in literature	Rogers, 2002	Rogers and Hall, 2003	WWAP, 2003	Ashton *et al.*, 2005	Ashton *et al.*, 2006	WWAP, 2006	Batchelor, 2007	Refined definition	Merged definition	Meta-Principle
Participative	The quality, relevance and effectiveness of government policies depend on ensuring wide participation throughout the policy chain -from conception to implementation. Improved participation is likely create more confidence in the end result and in the Institutions which deliver policies. Participation crucially depends on all levels of government following an inclusive approach when developing and implementing policies.		All citizens, both men and women, should have a voice – directly or through intermediate organizations representing their interests – throughout processes of policy- and decision-making. Broad participation hinges upon national and local governments following an inclusive approach.	The quality, relevance and effectiveness of policies, legislation, regulation and practice, depend on ensuring wide participation throughout the policy chain – from conception to implementation. Improved participation is likely to create more confidence in the end result and in the institutions which deliver and implement policies	Where the quality, relevance, and effectiveness of policies, legislation, regulation, and practice depend on public participation from conception to implementation, to create greater confidence in the institutions of governance and the outcomes of policy	All citizens, both men and women, should have a voice, directly or through intermediate organizations representing their interests, throughout processes of policy- and decision-making. Broad-based participation hinges upon national and local governments following an inclusive approach.		The quality, relevance and effectiveness of government policies, legislation, regulation and practice, depend on ensuring a wide, inclusive and informed participation of stakeholders (both men and women) and civil society, throughout the policy and decision-making processes, from conception, through implementation, to evaluation. Broad-based and engaged participation can legitimize policy and decision making processes, thus improving the efficiency in the implementation of policies and programs, and their outcomes.	Values associated with power sharing, representation and participation are essential in water governance. The quality, relevance and effectiveness of government policies, legislation, regulation and practice, depend on ensuring a wide, inclusive and informed participation of stakeholders (both men and women) and civil society, throughout the policy and decision-making processes, from conception, through implementation, to evaluation. Water governance has to provide opportunities for the participation of all men and women, regardless of their social, ethnical or religious conditions.	**Participation**
Inclusive		The quality, relevance and effectiveness of government policies depend on ensuring wide participation throughout the policy chain – from conception to implementation. Improved participation is likely to create more confidence in the end result and in the institutions that deliver policies [legitimization]. Participation crucially depends on all levels of government following an inclusive approach when developing and implementing policies. Broad participation is built on social mobilization and freedom of association and speech, as well as capacities to participate constructively.					Wide participation should be ensured throughout the water policy chain, from conception to implementation and evaluation			
Equitable	Equity between and among the various interest groups, stakeholders, and consumer-voters needs to carefully monitor throughout the process of policy development and implementation. It is essential that the penalties for malfeasance be, and be seen to be, equitably applied	All men and women should have opportunities to improve or maintain their well-being. Equity between and among the various interest groups, stakeholders, and consumer-voters needs to be carefully monitored throughout the process of policy development and implementation. It is essential that the penalties for malfeasance are, and are seen to be, equitably applied	All groups in society, both men and women, should have opportunities to improve their well-being.			All groups in society, both men and women, should have opportunities to improve their well-being.	Equity between and among various water interest groups, stakeholders and consumers should be carefully monitored throughout the policy development and implementation process;	Water governance has to provide opportunities for men and women to improve their well-being, and make safe drinking water available to all people regardless of their social, ethnic or religious conditions. Equity between and among the various interest groups, stakeholders, and civil society need to be carefully monitored throughout the policy development and implementation processes, applying a system of checks and balances.		
Democratic				Democratic values in respect of the sharing of power, representation and participation are essential.				Democratic values with respect of the sharing of power, representation and participation are essential		

Water governance principles defined by researchers

Proposed Meta-principle Coherence

Principle in literature	Rogers, 2002	Rogers and Hall, 2003	WWAP, 2003	Ashton *et al.*, 2005	Ashton *et al.*, 2006	WWAP, 2006	Batchelor, 2007	Refined definition	Merged definition	Meta-Principle
Coherent	Policies and action must be coherent and easily understood. The need for coherence in governance is increasing: the range of tasks has grown; and so has diversity; challenges such as climate and demographic change cross the boundaries of the sectoral policies on which the government has been built; regional and local authorities are increasingly involved in water policies. Coherence requires political leadership and a strong responsibility on the part of the institutions to ensure a consistent approach within a complex system.	Policies and action must be coherent. The need for harmony and coherence in governance is increasing as the range of tasks has grown and become more diverse. Challenges such as climate and demographic change cross the boundaries of the sectoral policies on which the government has been built. Coherence requires political leadership and a strong responsibility on the part of the institutions at different levels to ensure a consistent approach within a complex system.	The increasing complexity of water resource issues, appropriate policies and actions must be taken into account so that they become coherent, consistent and easily understood.	Policies and actions must be coherent and easily understood. Coherence requires political leadership and a strong responsibility on the part of the institutions to ensure a consistent approach within a complex system.	Where policies and implementation actions are consistent with other initiatives, and are clearly aligned and well understood by all participants.	Taking into account the increasing complexity of water resources issues, appropriate policies and actions must be coherent, consistent and easily understood.	Water policies and actions must be coherent, with political leadership and a strong responsibility taken by institutions at different levels	Decision makers have to ensure that policies, programs, regulations and actions in the water sector are coherent, consistent and clearly aligned with other initiatives, and are easy to follow and understand by all participants. Within a complex integrative system it is important that roles and responsibilities are clearly defined, in order to avoid conditions in which institutions and organizations at different scales, or at the same level, oppose or nullify each other.	Governance systems have to ensure that policies, programs, regulations and actions in the water sector are coherent, consistent and clearly aligned with other initiatives. It is important that roles and responsibilities of all institutions. Organizations and actors are clearly defined, in order to avoid conditions in which institutions, organizations and actors at different scales, or at the same level, oppose or nullify each other's programs and activities. Policies, programs, regulations and roles should be easy to follow and understand, in order to facilitate collaborative actions and activities, and create synergies among stakeholders. Decisions should be made and policies implemented at the most appropriate level, in order for policies and programs to be effective and timely, delivering what is needed where and when it is needed, while making the best use of resources and improving outcomes.	**Coherence**
Efficient	Classical economic theory demands efficiency in terms of economic efficiency, but there are also concepts of political, social, and environmental efficiency which need to be balanced against simple economic efficiency. For example, minimizing transaction costs will go a long way toward political efficiency.	Classical economic theory demands efficiency in terms of economic efficiency, but there are also concepts of political, social, and environmental efficiency which need to be balanced against simple economic efficiency. It is also essential that governance systems do not impede action, for example, minimizing transaction costs will go a long way toward political and economic efficiency.					Concepts of political, social, and environmental efficiency related to water resources must be balanced against simple economic efficiency; governmental systems should not impede needed actions.	Water governance systems should not impede or obstruct action, and should aim to balance the concepts of political, social, environmental and economic efficiency.		
Responsive		Policies must deliver what is needed on the basis of demand, clear objectives, an evaluation of future impact and, where available, of past experience. Responsiveness also requires policies to be implemented in a proportionate manner and decisions to be taken at the most appropriate level. Most importantly, the policies should be incentive-based. This will ensure that there is a clear social or economic gain to be achieved by following the policy.	Institutions and processes should serve all stakeholders and respond properly to changes in demand and preferences, or other new circumstances.			Institutions and processes should serve all stakeholders and respond properly to changes in demand and preferences, or other new circumstances.	Water demands, evaluation of future water impacts and past experiences should be the basis for water policy; policies should be implemented, and decisions made, at the most appropriate level	Decisions should be made and policies implemented at the most appropriate level, in order for policies and programs to deliver what is needed, when it is needed, and where is needed.		
Effective	Policies must be effective and timely, delivering what is needed on the basis of clear objectives, an evaluation of future impact and, where available, of past experience. Effectiveness also depends on implementing policies in a proportionate manner and on taking decisions at the most appropriate level. Most importantly, the policies should be incentive-based. This will ensure that there is a clear social or economic gain achievable by following the policy.			Policies must be effective and timely, delivering what is needed on the basis of clear objectives, an evaluation of future impact and, where available, of past experience. Effectiveness also depends on implementing policies in a proportionate manner and on taking decisions at the most appropriate level.	Where policies are timely and appropriate, delivering what is needed, based on decisions made during participative decision-making processes	Processes and institutions should produce results that meet needs while making the best use of resources.		Policies must be effective and timely, delivering what is needed, when it is needed. This depends on the ability of stakeholders to make informed decisions and implement policies at the most appropriate level, while making the best use of resources.		

Water governance principles defined by researchers

Proposed Meta-principle Rule of law

Principle in literature	Rogers, 2002	Rogers and Hall, 2003	WWAP, 2003	Ashton *et al.*, 2005	Ashton *et al.*, 2006	WWAP, 2006	Batchelor, 2007	Refined definition	Merged definition	Meta-Principle
Ethical	Above all, water governance has to be strongly based upon the ethical principles of the society in which it functions. This manifests itself most strongly in the issue of property rights for use, access, and ownership of water.	Above all, water governance has to be strongly based upon the ethical principles of the society in which it functions and based on the rule of law. This manifests itself most strongly in the issue of justice, property rights for use, access, and ownership of water. Legal and regulatory frameworks should be fair and enforced impartially.	Water governance has to be based on the ethical principles of the societies in which they function, for example by respecting traditional water rights			Water governance has to be based on the ethical principles of the societies in which it functions, for example, by respecting traditional water rights.	Penalties for corrupt behavior or sharp practices should be applied equitably – water governance must be strongly based on the ethical principles of the society in which it functions and on the rule of law.	Water governance has to be strongly based upon the ethical principles and context of the society in which it functions and on the rule of law. Legal and regulatory frameworks should be fair and applied impartially.	Water governance has to establish an enabling environment that is strongly based upon the ethical principles and context of the society in which it functions and on the rule of law. The "rules of the game" and the consequences for violation of those rules need to be clearly spelled out. The roles and responsibilities of all the institutions, organizations and actors involved in developing and implementing policy at all levels need to be clearly established, and they should be held accountable for their decisions and actions. It is necessary to have a built-in arbitration mechanisms to ensure that satisfactory solutions to water issues can be reached. Authority has to be legitimately exercised and in accordance to publically disclosed rules, and enforced in accordance with established procedure. Penalties for not complying with the rules or with responsibilities should be fair, clearly established, and applied impartially. A system of checks and balances should be established in order to monitor compliance with the law and with responsibilities, thus bringing clarity, transparency, legitimacy, and credibility to the water governance system.	**Rule of law**
Integrity				Leadership that is honest, faithful and diligent, and that protects human rights and freedoms, is critical.				Leadership that is honest, faithful and diligent, and that protects human rights and freedoms, is critical.		
Accountable	Roles in the legislative and executive processes need to be clearer. Each of the institutions must explain and take responsibility for what it does. But there is also a need for greater clarity and responsibility from all those involved in developing and implementing policy at whatever level. The "rules of the game" need to be clearly spelled out, as should the consequences for violation of the rules, and have built-in arbitration enforcing mechanisms to ensure that satisfactory solutions can still be reached when seemingly irreconcilable conflicts arise among the stakeholders.	Roles in the legislative and executive processes need to be clear. Each institution must explain and take responsibility for what it does. But there is also a need for greater clarity and responsibility from all those involved in developing and implementing policy at any level. The "rules of the game" need to be clearly spelled out, as should the consequences for violation of the rules, and have built-in arbitration enforcing mechanisms to ensure that satisfactory solutions can still be reached when seemingly irreconcilable conflicts arise among the stakeholders. Decision-makers in government, the private sector and civil society organizations are accountable to the public, as well as to institutional stakeholders. This accountability differs depending on the organization and whether the decision is internal or external to an organization.	Governments, the private sector and civil society organizations should be accountable to the public or interest they are representing	Roles in the legislative and executive processes need to be clear. Each institution must define and take responsibility for what it does. There is also a need for greater clarity and responsibility from all those involved in developing and implementing policy at whatever level.	Where every role in the legislative, administrative, and executive processes is made clear, and where there is appropriate clarity and responsibility from everyone who is involved in developing and implementing policy at every level	Governments, the private sector and civil society organizations should be accountable to the public or the interests they are representing.	The rules of the game, as well as legislative roles and executive processes, must be clear; each water-related institution must explain and take responsibility for its actions; penalties for violating the rules and arbitration-enforcing mechanisms must exist to ensure that satisfactory solutions to water issues can be reached.	There is a need for greater clarity with regards to the roles and responsibilities of all the institutions, organizations and actors involved in developing and implementing policy at all levels. This is particularly important in the case of the legislative and administrative roles, and executive processes. The "rules of the game" and the consequences for violation of those rules need to be clearly spelled out. Penalties for not complying with the rules should be equally applied. Government, private sector and civil social organization, have to be accountable for their decisions and actions. Built-in arbitration enforcing mechanisms needs to be established to ensure that satisfactory solutions to water issues can be reached.		
Rule of law						Legal frameworks should be fair and enforced impartially, especially laws on human rights.		Legal frameworks should be fair and enforced impartially, especially laws on human rights.		

Water governance principles defined by researchers

Proposed Meta-principle Knowledge

Principle in literature	Rogers, 2002	Rogers and Hall, 2003	WWAP, 2003	Ashton *et al.*, 2005	Ashton *et al.*, 2006	WWAP, 2006	Batchelor, 2007	Refined definition	Merged definition	Meta-Principle
Open	Institutions should work in an open manner. Together with the government agencies and private companies, they should actively communicate about what the institutions and the government do and the decisions they take. They should use language that is accessible and understandable for the general public. This is of particular importance in order to improve the confidence in complex institutions.	Institutions should work in an open manner. They should use language that is accessible and understandable for the general public to increase confidence in complex institutions. In addition to being open, good governance requires that all policy decisions are transparent so that both insiders and outsiders can easily follow the steps taken in the policy formulation. This is particularly important with regard to financial transactions.		Governance institutions should work in an open manner. They should actively communicate about what they do and the decisions that are taken. They should use language that is accessible and understandable for the general public.	Where governance institutions are transparent and inclusive, communicating freely about what they do and the decisions that are taken, using language that is accessible and understandable to all stakeholders.		Water institutions should work in an open and transparent manner, using language understandable to the general public; water policy decisions should be transparent, particularly regarding financial transactions.	Public, social, private and multilateral institutions should work in an open manner, actively communicating about what they do and the decisions they take, in a language that is understandable to all stake holders and the general public. This actions increase confidence in complex institutions.	Governance forums, networks and systems need actors and stakeholders to communicate in very direct ways. They should work in a clear and open manner, actively communicating about what they do and the decisions that are taken. All policy formulation processes and decisions should be made accessible and easy to follow by both insiders and outsiders. Information should flow freely (vertically and horizontally) in a language that is understandable to all stakeholders and the general public, and should be made readily available for public scrutiny. Information in the water sector can also be used for educational purposes, and for awareness campaigns.	**Knowledge**
Transparent	In addition to being open, good governance requires that all policy decisions are transparent so that both insiders and outsiders can easily follow the steps taken in the policy formulation. This is particularly important with regard to financial transactions, which should discourage suspicious or illegal transactions.		Information should flow freely within a society. The various processes and decisions should be transparent and open for scrutiny by the public.			Information should flow freely in society. Processes, institutions and information must be directly accessible to those concerned.		All policy formulation processes and decisions should be made accessible and easy to follow by both insiders and outsiders. Information has to flow freely in society, and made available for public scrutiny, thus providing transparency, credibility, and social accountability.		
Communicative	Governance institutions and systems need to communicate among the actors and stakeholders in very direct ways. Correctly done, this will lead civil society to be socialized into governance over a wide range of issues. Governance in the water sector can be used as an education model for all other sectors and vice-versa.	Transparency and accountability are built on the free flow of information. Governance institutions and systems need to communicate among the actors and stakeholders in very direct ways. Correctly done, this will lead civil society to be socialized into governance over a wide range of issues.					Governance institutions must communicate among water stakeholders both horizontally at the same levels and vertically between levels	Institutions, organizations, actors and stakeholders need to communicate in very direct ways. Information has to flow freely, both vertically and horizontally. Information can also be used for educational purposes and awareness campaigns.		

Water governance principles defined by researchers

Proposed Meta-principle Integration

Principle in literature	Rogers, 2002	Rogers and Hall, 2003	WWAP, 2003	Ashton *et al.*, 2005	Ashton *et al.*, 2006	WWAP, 2006	Batchelor, 2007	Refined definition	Merged definition	Meta-Principle
Integrative	Water governance should enhance the effectiveness of Integrated Water Resources Management (IWRM). The institutions will have to consider all uses and users within the traditional water sector and also their interconnections with and impacts upon all other potential users and sectors.	Water governance should enhance the effectiveness of Integrated Water Resources Management (IWRM). The institutions will have to consider all uses and users within the traditional water sector and also their interconnections with and impacts upon all other potential users and sectors.	Water governance should enhance and promote integrated and holistic approaches			Water governance should enhance and promote integrated and holistic approaches	Water institutions should consider all potential water users and sectors and their linkages with, and impacts on, the traditional water sector.	Water governance should promote an enabling environment that induces institutions and decision-makers to consider all uses and users within the traditional water sector, as well as the prevailing conditions at the local context. They should also take into account their existing and possible interconnections, and their impacts upon all other potential users and sectors, following an integrated and holistic approach.	During the policy and decision making processes, decision-makers have to consider present and future freshwater uses and users, including aquatic and terrestrial ecosystems, and aim towards the long-term sustainability of water resources. Decisions should be strongly based upon local traditions and context, and take into account existing and possible interconnections and their impacts upon all other potential users and sectors, following an integrated and holistic approach.	**Integration**
Sustainable	Water governance must serve future as well as present users of water services.	The institutions should also be built with an eye toward long-term sustainability. Water governance must serve future as well as present users of water services.					Water policies should be incentive-based, to ensure clear social or economic gain if the policy is followed; long-term sustainability of water resources should be the guiding principle	Water governance must serve future as well as present users of water services, and aim towards long-term sustainability of water resources.		

Appendix III: Content Analysis Code Book

Principle	Governance Context	Autocracy Context
Rule of law	The existence of a comprehensive set of laws, norms, rules and regulations (formal and/or informal) that govern over water resources. The presence of authority that is legitimately exercised and in agreement with publicly disclosed norms and rules (formal and/or informal). The establishment of institutional roles that distribute power effectively with existing checks and balances. The existence of arbitration forums for conflict resolution and management. The establishment of legal stakeholder roles (both formal or informal).	Deficiencies in legislation such as the existence of gaps, overlaps or contradictory laws, norms, rules and/or regulations (formal and/or informal). Deficiencies in law enforcement. Administrative, operative, normative, enforcement and sanction roles being dominated by individual institutions. Arbitrary actions and decisions, abuses and corruption. Lack of accountability among stakeholders.
Participation	The engagement of multiple stakeholders (e.g., governments, civil social organizations and private sector) in decision making. Stakeholders engaged in decision-making at various scales (from basin to local levels) within water governance forums. Effective top-down and bottom-up networks. Legitimate multi-stakeholder and multi-sectorial representation including minorities or marginalized groups.	Stakeholder participation limited to consultation. Important negotiations and decisions are made by top politicians, outside water governance forums. No clear guidelines for the election of representatives. Failure of representatives to adequately cater to the needs of their respective stakeholder groups
Coherence	Decentralization of authority and responsibility to the most appropriate level of social aggregation. Stakeholders' collaborative activities (both formal and informal) are coordinated to achieve common goals and objectives. Clearly established institutional roles and responsibilities. The available of sufficient resources (e.g., financial, staff, equipment) that make it possible for stakeholders to be administratively and operationally functional, and fulfill their duties effectively.	Centralization of authority and decision making (top-down approach). Uncoordinated sectoral approach to policy, planning, and management of water resources. Stakeholder roles and responsibilities are not clearly established. Stakeholders are poorly funded, staffed and/or equipped to fulfill their duties effectively.

Principle	Governance Context	Autocracy Context
Knowledge	Stakeholder negotiations is characterized by equality, transparency, open dialogue and direct communication. Up-to-date information is shared and accessible for decision making, awareness raising, and public scrutiny, in clear and simple terminology. The presence of capacity building programs and activities for staff and stakeholders. The presence of forums and awareness campaigns/activities for the general population.	Information is collected independently by stockholders and shared under specific conditions or on a need to know basis. Reliability of available information is questionable, or too technical and difficult to understand by non-experts. Insufficient capacity building programs and activities. Awareness campaigns are localized or have a sectoral focus.
Integration	The use of the basin as a unit for water resources planning and management to enhance hazard mitigation, water source protection, water pollution controls and other activities that sustain water resources in an effective manner. Decision making takes into account present and future demands of water users, aiming towards long-term sustainability (e.g., conservation of vital aquatic and terrestrial ecosystems).	Uses political boundaries for planning and managing water resources instead of using the basin scale. Economic development is the priority, regardless of anthropogenic induced scarcity and negative environmental impacts, including pollution.

Appendix IV: Checklist for in-depth interviews

Interview Guide

Topic 1 The role played by all three levels of government and water users in governance forums and networks.

- What is your (or your institution's) role in the Lerma-Chapala Basin Council (could be direct or indirect)?
- Do you know who are the other members of the LChBC and what are their roles? If yes, who are they and what do they do?
- What roles do the three levels of government play with regards to investment in drinking water and sanitation infrastructure today (at present times)? What role do the social and private sector play in decision-making with regards to this type of investment today? Are you familiar with the processes to get these investments selected and approved today? If yes, what is this process? Who approves these investments?
- What kinds of decisions are made by the municipal and state governments with regards to water management?

Topic 2 The type of issues and concerns brought forward and discussed within the LChBC.

- What kind of issues and concerns are brought forward and discussed in the LChBC? Examples?
- What mechanisms are applied to incorporate water user representatives into decision-making processes? Examples?
- What mechanisms are used by the LChBC to inform stakeholders about the problems present in the basin and about the "hot spots" that require immediate attention?
- How does the LChBC inform stakeholders (and the population in general) about the issues addressed by the Council, about the resolutions reached to alleviate these issues, about the implementation or enforcement activities, about progress regarding resolutions, and about the results obtained through the actions taken to solve such issues?

Topic 3 Stakeholders' role the LChBC, their engagement in decision making, and in the execution of agreements (if any).

- Who are the stakeholders that are engaged in decision-making processes in the LChBC? What type of decisions are they engaged in?
- In what kind (or type) of issues do you (or your institution) are engaged in?
- How are stakeholders concerns brought to the attention of the LChBC and how are they addressed?
- How does the LChBC make sure that stakeholders comply with the implementation of agreements reached by the Council?

- How do you (or your institution) visualize stakeholder engagement taking place in the LChBC?

Topic 4 The role of the LChBC in the implementation of an IWRM process;

- Is there a management plan for the LChB elaborated by the Council? If yes, how was plan developed? Who were the stakeholders engaged in its development? How was it approved?
- How does the LChBC addresses problems that threaten the conservation and sustainability of water resources (quality and quantity of surface and groundwater) in the basin?
- Do stakeholders get involved (directly or indirectly) in solving problems that are generated outside their state or municipality (up-river, down-river)? What mechanisms or forums are available to address these problems?
- Does the LChBC deal with issues that involve resources different than water (forest and soil)? If yes, Examples?
- Who speaks for the natural environment in the LChBC (the environment is considered a water user in Mexican legislation)?
- What mechanisms are available to address controversial issues (conflicts) in the LChBC?

Topic 5 The degree of cooperation and coordination among institutions, organizations and water users in the implementation of policies, plans and programs.

- What mechanisms (or processes – if any) are used by the LChBC to stimulate dialogue and negotiations and the coordination of collaborative activities? If yes, what kind of collaborative activities are there in the LChBC? Who are the stakeholders usually involved in these type of negotiations and activities?
- Are you aware of other water governance forums that address relevant water issues in the basin (state, municipal, sub-or micro-basin, or aquifer levels)? If yes, which one? What kind of issues does this forum address? Who are the stakeholders engaged in the governance forum? How are stakeholder representatives elected (or chosen)?
- Is the work of these water governance forums linked with the activities of the LChBC?

Topic 6 The capacities of the LChBC and of its members (where applicable) with regards to human resources, professional profiles, equipment, funding, training, and information flow and availability.

- What strengths does your institution (organization) have to offer to improve water problems in the LChB? How are these strengths contributing to the LChB with the present governance system?
- Do you think your institution (organization) could contribute more than it does at present? If yes, how? What is preventing you from contributing more?

- Do you think that the different institutions and organizations in the LChBC have the capacities required to implement an effective IWRM process in the basin? Why?
- Do you think there are enough institutional capacities (financial, human resources, equipment, etc.) in the LChBC to implement an IWRM process? If no, what capacities need to be improved upon and in what institutions or organizations?

Topic 7 Limitations and opportunities to establish an effective water governance system in the LChB.

- What kind of information is available to the members of the LChBC to help them formulate their decisions on the issues brought to the table? If limited, what can be done to make relevant information more readily available?
- What is your opinion on the present levels of transparency, accountability and credibility in decision-making and implementation processes in the LChBC? If negative, what modifications or specifications do you think are needed to strengthen present levels?
- What do you think is the perception of the population about the LChBC and what it does? If negative, what can be done to inform civil society about the issues dealt with in the LChBC and raise awareness about water problems in the basin?
- How would you describe the level of stakeholder participation in the LChBC? If negative, what can be done to encourage a more active participation of water users (civil society in general) in governance forums such as the LChBC?
- What can be done to improve water management in the basin using the LChBC and as a platform for negotiation among stakeholders?
- Are there any limitations you perceive for the establishment of an effective water governance system in the LChB?
- What opportunities do you see that could establish an effective water governance system in the LChB?

Topic 8 Improvements to the governance system in the basin.

- What changes would you suggest to strengthen the water governance systems in the basin?

Complementary questions (in a few words):

❖ What does integrated water resources management mean to you?

❖ What does water governance mean to you?

❖ How would you describe the role of the LChBC (as a governance forum) in the implementation of an IWRM process?

Appendix V: Percentage of texts occurring in the context of the five principles within each document

Table 1: Percentage of texts occurring in the context of the five principles within each document
(Mexico's water laws)

Water Law	Paradigm Shift (1992)	Post-Rio Context						Pre-Rio Context					
		Rule of Law	Participation	Integration	Coherent	Knowledge	**Total**	Rule of Law	Participation	Integration	Coherent	Knowledge	**Total**
1972 FWL	Before	6	1	2	6	3	18	0	4	1	0	0	5
1992 NWL	After	13	4	6	6	9	38	0	2	0	0	0	2
2004 NWL		13	3	6	8	9	39	0	1	0	0	0	1

**Note: These percentages are relative to the individual document. The totals represent that total percentage of each document that pertained to the five principles. Results in a post-Rio context demonstrate agreement with the definition of the five principles proposed in this thesis, while pre-Rio context indicate non-compliance with the definitions provided for the five water governance principles. Includes all water laws at the federal level between 1972 and 2008.*

FWL: Federal Water Law
NWL: National Water Law

Table 2: Percentage of texts occurring in the context of the five principles within each document
(Mexico's water policy documents)

Water Policy	Paradigm Shift (1992)	Post-Rio Context						Pre-Rio Context					
		Rule of Law	Participation	Integration	Coherent	Knowledge	**Total**	Rule of Law	Participation	Integration	Coherent	Knowledge	**Total**
1975 NHP	Before	1	1	3	3	2	10	0	1	2	1	0	4
1981 NHP		2	1	4	2	3	12	0	1	4	0	1	6
1984 NHP		2	1	4	2	2	11	1	2	3	2	0	8
1995-2000 NHP	After	4	2	6	4	4	20	0	2	2	0	0	4
2001-2006 NHP		3	3	8	5	3	22	0	1	3	1	0	5
2007-2012 NHP		2	2	5	4	3	16	0	1	0	0	0	1

**Note: These percentages are relative to the individual document. The totals represent that total percentage of each document that pertained to the five principles. Results in a post-Rio context demonstrate compliance with the definition of the five principles proposed in this study, while pre-Rio context indicate non-compliance with the definitions provided for the five water governance principles. All accessible water policy documents between 1975 and 2012 are included in the sample.*

NHP: National Hydraulic Program/Plan

Table 3: Percentage of texts occurring in the context of the five principles within each document
(Mexico's institutional structure documents)

Internal Regulations	Paradigm Shift (1992)	Post-Rio Context						Pre-Rio Context					
		Rule of Law	Participation	Integration	Coherent	Knowledge	**Total**	Rule of Law	Participation	Integration	Coherent	Knowledge	**Total**
1977 MHSPW	Before	5	0	1	2	3	11	0	0	0	0	0	0
1977 MAHR		5	0	1	3	6	15	0	1	0	0	0	1
1983 MUDE		7	0	1	4	5	17	0	0	0	0	0	0
1985 MAHR		8	0	1	5	6	20	0	1	1	0	0	2
1989 MAHR		9	0	2	4	3	18	0	0	0	0	0	0
1993 MAHR	After	11	0	3	5	4	23	0	0	0	0	0	0
1996 MENRF		11	1	3	5	5	25	0	1	0	0	0	1
2001 MENR		10	2	2	5	5	24	0	2	0	0	0	2
2006 MENR		10	1	3	8	6	28	0	2	0	0	0	2

**Note: These percentages are relative to the individual document. The totals represent that total percentage of each document that pertained to the five principles. Results in a post-Rio context demonstrate agreement with the definition of the five principles proposed in this thesis, while pre-Rio context indicate non-compliance with the definitions provided for the five water governance principles. Because of the vast number of reforms to institutions that occurred over time, only documents that recorded major changes to institutional structures related to water resources were included in the analysis. Therefore, changes to areas with no direct implications for water resources (e.g., livestock, fisheries, forestry, and housing), are not considered as 'major changes' to the institutional structures because they have no effect on results nor do they contribute to the analysis.*

MHSPW: Ministry of Human Settlements and Public Works
MUDE: Ministry of Urban Development & Ecology.
MAHR: Ministry of Agriculture & Hydraulic Resources.
MENRF: Ministry of the Environment, Natural Resources and Fisheries
MENR: Ministry of the Environment & Natural Resources.

Appendix VI: Percentage dominance of water governance principles within stakeholder interviews

Table 1: Percentage Dominance of Water Governance Principles within Stakeholder Interviews

Stakeholder Groups	Post-Rio Context						Pre-Rio Context					
	Rule of Law	Participation	Integration	Coherent	Knowledge	**Total**	Rule of Law	Participation	Integration	Coherent	Knowledge	**Total**
Water Users	0	2	3	2	1	9	13	33	10	13	22	91
State Officials	1	5	9	4	1	19	13	21	11	20	16	81
Federal Officials	2	11	6	6	3	28	11	21	8	18	15	72

**Note: Results in a post-Rio context demonstrate compliance with the definition of the five water governance principles proposed in this study, while pre-Rio context indicate non-compliance with the definitions. Values show relative percentages of repetition of topics concerning the five water governance principles proposed in this thesis, in a pre-Rio and a post-Rio contexts. The levels of repetition are characterized based on stakeholder type.*

Appendix VII: Percentage of respondents by principle, context and theme

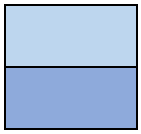
Principle	Context	Theme	Percentage of respondents by group			All Respondents (%)
			Water users	State officials	Federal officials	
Rule of law	Post-Rio	Comprehensive of rules & regulations	0	47	38	28
		Institutional structures for water management	4	20	46	23
		Law enforcement	9	0	31	13
	Pre-Rio	Legislation gaps & overlaps	83	80	85	83
		Inadequate institutional structuress	87	80	77	81
		Negligible law enforcement	87	93	77	86
Participation	Post-Rio	Participation in multilateral decision-making forums	26	73	85	61
		Multiple stakeholder engagement	52	73	100	75
	Pre-Rio	Little participation / governments make decisions	91	100	100	97
		Questionable water user's representation	87	93	100	93
Coherence	Post-Rio	Collaboration & coordination	30	60	85	58
		Decentralization to the lowest viable level	52	67	92	70
		Operational capacities	4	7	31	14
	Pre-Rio	Fragmentation & sectoralization	91	100	100	97
		Centralized decision making	78	100	92	90
		Insufficient operational capacities	83	80	77	80
Knowledge	Post-Rio	Information systems	22	13	46	27
		Education	13	0	54	22
		Dialogue & negotiation	17	27	31	25
	Pre-Rio	Inefficient information system	74	87	69	77
		Insufficient education	100	93	85	93
		Lack of transparency	100	100	92	97
Integration	Post-Rio	Basin planning & management	61	100	77	79
		Sustainability & Conservation	52	100	77	76
	Pre-Rio	Regional development planning & management	96	100	100	99
		Negative environmental impacts	70	40	38	49

Appendix VIII: Respondents key list

List of Characters and Numbers to Identify Respondents

Sector	Federal Entity*	Respondent Number
Aquaculture (water users)	B	1
	C	2
	D	3
	E	4
Agriculture (water users)	A	5
	B	6
	C	7
	E	8
Industrial (water users)	B	9
	C	10
	E	11
Livestock (water users)	A	12
	B	13
	C	14
Municipal water services (water users)	B	15
	C	16
	D	17
	E	18
Other services (water users)	A	19
	B	20
	C	21
	D	22
	E	23
State Water Institutions	A	24
	B	25
	C	26
	D	27
	E	28

* Name of states was withheld for confidentiality purposes.



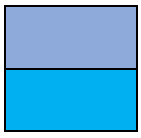
Water users

State officials

List of Characters and Numbers to Identify Respondents (cont.)

Sector	Federal Entity*	Respondent Number
Environment State Institutions	A	29
	B	30
	C	31
	D	32
	E	33
Agriculture State Institutions	A	34
	B	35
	C	36
	D	37
	E	38
National Water Commission	A	39
	B	40
	C	41
	D	42
	E	43
	F	44
Ministry of the Environment and Natural Resources	A	45
	B	46
	C	47
	D	48
	E	49
	F	50
Ministry of Agriculture, Livestock, Rural Development, Fisheries and Food	F	51

* Name of states was withheld for confidentiality purposes.



State officials

Federal officials

Appendix IX: Summary of findings by water governance principle

Summary of findings for Participation

Context	Theme	Constraints					Achievement
		FWUR[1]	FSUA[2]	DMRC[3]	NHMR[4]	SNWC[5]	SWAA[6]
Post-Rio	Participation in multilateral decision-making forums	The only important decision made by the LChBC is the yearly allocation of surface water ^.		*Decentralization policies include basin councils and their subsidiary organizations* *.			Water users and government representatives participated in negotiations and decision making in the Arrangement and Allocation Workgroup of the LChBC ^.
	Multiple stakeholder engagement	Water users engaged in determining the yearly allocation of surface water for the basin ^.					Water users and government representatives negotiated and reached an agreement on the methodology to determine the yearly allocation of surface water in the basin ^.
Pre-Rio	Little participation / governments make decisions	Most decisions for water planning, development and management are made between governments, outside the River Basin Council ^.		Traditional authoritarian forces in the NWC do not see water user engagement as an important component in water governance ^.			
	Questionable water user's representation	Some water user representatives have not been elected by their peers ^. Water user's interests and concerns are not being advanced in the LChBC ^.					

[1] (FWUR) Failure of water user representatives to advance issues that pertain to their stakeholder group in the Lerma-Chapala Basin Council.
[2] (FSUA) A fragmented, sectoral and uncoordinated approach to water management that limits the potential impact of programs and activities that are being implemented in the Lerma-Chapala basin.
[3] (DMRC) Decision making remains centralized and does not consider local context.
[4] (NHMR) Not having the mandatory Regulations of the 2004 National Water Law creates a significant gap in Mexico's water legislation.
[5] (SNWC) General institutional structure of the National Water Commission is restraining its capacity to function efficiently.
[6] (SWAA) 2004 Surface Water Allocation Agreement.
(*) Findings from official documents data analysis.
(^) Findings from Interview data analysis.

Summary of findings for Coherence

Context	Theme	Constraints					Achievement
		FWUR[1]	FSUA[2]	DMRC[3]	NHMR[4]	SNWC[5]	SWAA[6]
Post-Rio	Collaboration and coordination		*IWRM encourages collaboration among all sectors and levels of government in a basin* *. Collaborative networks (formal and informal) in the basin, not linked to the LChBC ^.				
	Decentralization to the lowest viable level	*Auxiliary Organizations for public participation* *.		*Decentralization reforms since the 1980s* *. Sub-basin Commissions, and COTAS have been created in the basin ^.			Decision made by stakeholders at the basin level^
	Operational capacities						
Pre-Rio	Fragmentation and sectorization	Precarious information flow between water user representatives and representees ^.	Silo approach to planning and management due to political, institutional, occupational and professional biases ^.	Limited or no collaboration activities between the LChBC and its Auxiliary Organizations ^.			
	Centralized decision making			Decisions still made at National Water Commission's headquarters (top-down)^.	No clear roles and responsibilities for RBOs thus decisions still made by the NWC's headquarters ^.		
	Insufficient operational capacities					Not enough staff in NWC to fulfill their mandate ^.	

[1] (FWUR) Failure of water user representatives to advance issues that pertain to their stakeholder group in the Lerma-Chapala Basin Council.
[2] (FSUA) A fragmented, sectoral and uncoordinated approach to water management limits the potential impact of programs and activities that are being implemented in the LCHB.
[3] (DMRC) Decision making remains centralized and does not consider local context.
[4] (NHMR) Not having the mandatory Regulations of the 2004 National Water Law creates a significant gap in Mexico's water legislation.
[5] (SNWC) General institutional structure of the National Water Commission is restraining its capacity to function efficiently.
[6] (SWAA) 2004 Surface Water Allocation Agreement.
(*) Findings from official documents data analysis.
(^) Findings from Interview data analysis.

Summary of findings for Rule of Law

Context	Theme	Constraints					Achievement
		FWUR[1]	FSUA[2]	DMRC[3]	NHMR[4]	SNWC[5]	SWAA[6]
Post-Rio	Comprehensive rules and regulations	*Enabling environment that promotes stakeholder participation* *.			*Mandatory Regulations to the 2004 NWL to be enacted within twelve months from the publication of the law* *.		*Enabling environment for stakeholder dialogue and negotiation to seek solutions to water problems* *.
	Institutional structures for water management	*Stakeholder participation can take place at RBCs and subsidiary organizations* *.		*2004 National Water Law reinforce decentralization policies for the water sector* *.	*Roles and responsibilities of RBOs and restructuring of RBCs to be determined in Regulations to the 2004 NWL* *.	*The NWC is the sole water authority. National and regional levels subordinated to the Director General's Office* *.	*Stakeholders dialogue, negotiate, and make decisions in RBCs* *. Workgroup negotiated agreement and oversees its implementation ^.
	Law enforcement						
Pre-Rio	Legislation gaps and overlaps	Unprecise election process for water user representatives ^.			Mandatory Regulations of the 2004 NWL have not been enacted, creating management and structural problems ^.		
	Inadequate institutional structures	Not enough Auxiliary Organizations in the basin ^.		Partial decentralization achieved ^.		Management and regulatory roles are merged under a single authority ^.	
	Negligible law enforcement			2004 National Water Law is being partially applied, raising questions on accountability ^.	No monitoring or oversight of volumes extracted, no cancellation of illegal wells ^. Lack of accountability because there are no clear roles for RBOs and NWC headquarters ^.	NWC at local level not fulfilling supervision, oversight and law enforcement duties ^.	

[1] (FWUR) Failure of water user representatives to advance issues that pertain to their stakeholder group in the Lerma-Chapala Basin Council.
[2] (FSUA) A fragmented, sectoral and uncoordinated approach to water management limits the potential impact of programs and activities that are being implemented in the LChB.
[3] (DMRC) Decision making remains centralized and does not consider local context.
[4] (NHMR) Not having the mandatory Regulations of the 2004 National Water Law creates a significant gap in Mexico's water legislation.
[5] (SNWC) General institutional structure of the National Water Commission is restraining its capacity to function efficiently.
[6] (SWAA) 2004 Surface Water Allocation Agreement.
(*) Findings from official documents data analysis.
(^) Findings from Interview data analysis.

Summary of findings for Knowledge

Context	Theme	Constraints					Achievement
		FWUR[1]	FSUA[2]	DMRC[3]	NHMR[4]	SNWC[5]	SWAA[6]
Post-Rio	Information systems						Information was made available to all participants during the negotiations to aid in decision making ^.
	Education						Provided explanation of complex concepts in mathematical models during negotiations ^.
	Dialogue and negotiation			*RBOs are not subordinated to any other areas at the NWC's headquarters**.			Two years of dialogue and negotiations between stakeholders to reach an agreement for surface water allocation ^.
Pre-Rio	Inefficient information systems		No mechanisms to inform water users or the general public about the LChBC, its purpose or activities ^.		Inaccurate or unreliable data in the Public Registry of Water Concessions ^.		
	Insufficient education	Water users have little or no knowledge about the Council's purpose or structure, or about their role in the Council ^.	Difficult collaboration because stakeholders have little knowledge of issues in other states or water uses ^.				
	Lack of transparency	Partial or no information about the Council's activities reaching water users ^.	Vertical and horizontal information flows are weak or nonexistent ^.	Decision making remains largely centralized at the NWC's headquarters ^.	No clear mechanisms for the allocation of groundwater volumes^. Roles of RBOs, RBCs, and NWC's headquarters are not clear ^.		

[1] (FWUR) Failure of water user representatives to advance issues that pertain to their stakeholder group in the Lerma-Chapala Basin Council.
[2] (FSUA) A fragmented, sectoral and uncoordinated approach to water management limits the potential impact of programs and activities that are being implemented in the LChB.
[3] (DMRC) Decision making remains centralized and does not consider local context.
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[5] (SNWC) General institutional structure of the National Water Commission is restraining its capacity to function efficiently.
[6] (SWAA) 2004 Surface Water Allocation Agreement.
(*) Findings from official documents data analysis.
(^) Findings from Interview data analysis.

Summary of findings for Integration

Context	Theme	Constraints					Achievement
		FWUR[1]	FSUA[2]	DMRC[3]	NHMR[4]	SNWC[5]	SWAA[6]
Post-Rio	Basin planning and management			*Basin plans to be developed by basin council in collaboration with River Basin Organizations* *.			Agreement considers the basin as the unit for the allocation of surface water ^.
	Sustainability and Conservation						
Pre-Rio	Regional development planning and management		Stakeholders do not plan, think, or envision the basin as a unit ^.	Water policy, plans or programs are not developed at the basin, sub-basin, micro-basin or aquifer level ^.			
	Negative environmental impacts				New wells being drilled in overexploited aquifers due to lack of regulation for water banks. Groundwater depletion increasing ^.	Persistent water pollution, illegal wells, groundwater overexploitation because of negligible enforcement ^.	

[1] (FWUR) Failure of water user representatives to advance issues that pertain to their stakeholder group in the Lerma-Chapala Basin Council.
[2] (FSUA) A fragmented, sectoral and uncoordinated approach to water management that limits the potential impact of programs and activities that are being implemented in the Lerma-Chapala basin.
[3] (DMRC) Decision making remains centralized and does not consider local context.
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[5] (SNWC) General institutional structure of the National Water Commission is restraining its capacity to function efficiently.
[6] (SWAA) 2004 Surface Water Allocation Agreement.
(*) Findings from official documents data analysis.
(^) Findings from Interview data analysis.

Appendix X: Example of invitation to a meeting of the Evaluation and Monitoring Group of the Lerma-Chapala Basin Council.

CONSEJO DE LA CUENCA LERMA-CHAPALA

SECRETARÍA TÉCNICA

Circular No: ST 2488

Asunto: *INVITACIÓN A LA CV SESIÓN ORDINARIA DEL GSE DEL CONSEJO DE CUENCA LERMA CHAPALA*

Guadalajara, Jalisco, a **15 JULIO 2008**

[redacted]

P r e s e n t e:

Con base en los acuerdos generados en la CIV Sesión Ordinaria del Grupo de Seguimiento y Evaluación de este Consejo de Cuenca, celebrada el día 07 de mayo de 2008 en Querétaro, Qro., y por conducto de esta Secretaría Técnica, me permito hacerle una cordial invitación para que participe en la CV (Centésima Quinta) Sesión Ordinaria del Grupo de Seguimiento y Evaluación del Consejo de Cuenca Lerma-Chapala; misma que se llevará a cabo el **miércoles 30 de julio del año en curso, a partir de las 10:30 hrs.**, en el Hotel Real de Chapala, sito en Paseo del Prado No. 20, Fraccionamiento La Floresta, Tel. (01376) 765 0014, en Ajijic, Municipio de Chapala, Jalisco, de acuerdo al siguiente ***Orden del Día***:

HORA	ACTIVIDAD
10:30	Registro de participantes.
11:00	Palabras de bienvenida.
11:05	Seguimiento de Acuerdos de la CIV Sesión Ordinaria.
11:20	Informe de los Grupos Especializados y presentación de sus Programas de Trabajo: • Aguas Subterráneas. [redacted] • Cultura del Agua. [redacted] • Uso Eficiente en Ciudades. [redacted] • Uso Eficiente en el Campo. [redacted] • Saneamiento. [redacted] • Sustentabilidad. [redacted] • Ordenamiento y Distribución. [redacted]
12:30	Seguimiento al Convenio de Coordinación y Concertación de las Aguas Superficiales de la Cuenca Lerma-Chapala.
12:40	RECESO.
12:50	Informe de las gestiones en relación a la tarifa especial para la operación de las PTAR.
13:00	Presentación del "Programa Cuenca Limpia".
13:20	Asuntos Generales.
13:30	Lectura de Acuerdos y firma del Acta de la CV Sesión
13:40	Clausura de la Sesión.

Esperando contar con su valiosa y puntual asistencia, le envío un cordial saludo. Para dudes o aclaraciones favor de comunicarse al 0133 3527 2560 o al correo: santiago.gonzalez@cna.gob.mx

A t e n t a m e n t e
El Secretario Técnico del GSE

[redacted]

"2008. Año de la Educación Física y el Deporte"

c.c.p.- [redacted] Coordinador General de Atención a Emergencias y Consejos de Cuenca.- México, D.F.
[redacted] Subdirector General Técnico de la CNA.- México, D.F.
[redacted] Gerente de Consejos de Cuenca de la CONAGUA.- México, D.F.

Appendix XI: Curriculum Vitae

Curriculum Vitae

Luis Francisco Silva Jimenez

Education and training

2005 – present	Philosophy Doctor - Geography Western University Thesis: *Water Governance in the Lerma-Chapala Basin of Mexico: A Shift from State-centred to a Multi-stakeholder Approach?*
2003 - 2005	Master of Environmental Studies – Geography University of Waterloo Thesis: *Sustainable Water Resource Management: Capacity Building and Public Participation in the Lerma-Chapala Basin, Mexico.*
1989 - 1993	Bachelor of Environmental Studies – Geography (Honours) University of Waterloo Thesis: *Coastal Tourism Development Planning in Mexico: Ixtapa-Zihuatanejo and Cancun case study.*

Scholarships / Grants

2005-2008	The University of Western Ontario Graduate Research Scholarship.
2007	Terralingua, Travel Grant (February 9 to 18), Chihuahua, Mexico.
2006	International Human Dimensions Programme on Global Environmental Change (IHDP) /Asia-Pacific Network on Global Environmental Change (APN), Workshop funding and Travel Grant (October 10 to 29), Chiang Mai, Thailand.
2005	Central American Water Resource Management Group, Travel Grant (March 6 to 12), Managua, Nicaragua.
2003-2004	University of Waterloo Graduate Research Scholarship.
2004	Central American Water Resource Management Group, Research Award.
2001	Guanajuato State Water Commission, Travel Grant (April 8 to 14), Habana, Cuba.
1987	Northland College, Entrance Scholarship.

Academic Experience:

Guest Lecturer:

Guest Lecturer. Government, Communities, NGO's and Development in Mexico. Personal Experiences. Presented to PSCI453/651, Advanced Topics in Third World Politics and Development. University of Waterloo, October 2003.

Guest Lecturer. Indigenous People in Latin America. Presented to PSCI350B, The Politics of Developing Areas. University of Waterloo, February 1993.

Teaching Assistant:

Graduate Teaching Assistant (2007), People, Places and Landscapes GEOG024, University of Western Ontario.

Graduate Teaching Assistant (2007), Environment, Economy and Society GEOG153A, University of Western Ontario.

Graduate Teaching Assistant (2006), Geopolitics GEOG148B, University of Western Ontario.

Graduate Teaching Assistant (2006), World Cities GEOG155, University of Western Ontario.

Graduate Teaching Assistant (2005), Economic Geography GEOG270, University of Western Ontario.

Graduate Teaching Assistant (2005), Resource Planning and Management GEOG154G, University of Western Ontario.

Graduate Teaching Assistant (2004), Resource Management, University of Waterloo.

Graduate Teaching Assistant (2003), Human Geography, University of Waterloo.

Teaching Assistant (1988), Ecology of the Tropical Rain Forest and Native People (field course in southern Mexico). Northland College.

Teaching Assistant (1987), Spanish. Northland College.

Research Assistant:

Research Assistant, Department of Political Sciences, University of Waterloo (2003).
Duties include:

- Research topics related to: pesticide use in floriculture, cut-flower world markets, cut-flower world producers, pesticide impact on peasant's health, women's role in the cut-flower industry, and the cut-flower industry in Latin America.

Research Assistant, Department of Political Sciences, University of Waterloo (1991).
Duties include:

- Assist in field research in the Ecuadorian Andes on topics related to: land and agrarian reform, government and NGO development rural programs, liberation theology, ethnic identity, and agrarian social movements.

Non-Academic Experience

Consultant, Terralingua (2006).
Duties include:

- Provide a document on the geology, hydrology and forest resources of the region of Norogachi in the municipality of Guachochi, Chihuahua, in northwestern Mexico, as part of the project “Eco-cultural Health in the Sierra Tarahumara”.

Technical Specialist, Marshal Mackin Monaghan Limited (2002)

Duties include:

- Develop a work plan for a project proposal pertaining alternative working activities within the formal sector of the economy, for the people working in the informal sector collecting recyclables from the garbage in the dump of Tegucigalpa, Honduras.

Director General of Social Development, Guanajuato State Water Commission (2000 - 2002).

Duties include:

- Negotiate with 33 municipal governments the creation of interdisciplinary teams to provide technical and administrative support for drinking water and sanitation service utilities in rural communities.
- Plan, implement, supervise and evaluate a capacity building program involving 33 interdisciplinary municipal teams that service over 700 rural communities.
- Implement a watershed management program with a strong emphasis on public participation. Fifteen Water User Organizations collaborate with the state, federal and municipal governments aiming to balance overexploited aquifers and reduce pollution levels, among other activities.
- Develop regulations for a government trust that supports water user organizations and supervise it.
- Supervise and provide input in awareness programs related to water preservation (quality /quantity).

Head Promotion Executive, Mid-West Regional Development Council of the State of Guanajuato (1999 – 2000).

Duties include:

- Develop a regional, environmental and recreational management project for the “Purísima Reservoir” with the participation of community members, private sector, landowners, civil social organizations including NGO’s and federal, state and municipal governments.
- Supervise a multidisciplinary team working to improve the quality of life in very poor highland communities. This was done applying community development strategies, combined with the rehabilitation of depleted natural resources, within a River Basin Management approach.
- Prepare and promote the Regional Development Support Program for the years 2000 and 2001; and get the projects approved by the councillors (i.e., civil social organizations, private sector, and government representatives form eight municipalities) and by the corresponding administrative authorities.

Assistant State Representative for Natural Resources, Federal Attorney's Office for Environmental Protection (1995-1999).

Duties include:

- Research and elaborate diagnostics on fisheries, wildlife and forestry activities in the states of Tabasco and Guanajuato, Mexico, in order to plan and implement law enforcement activities.
- Field supervision of enforcement activities related to fisheries, flora, fauna, forestry, environmental impact assessment, the Centla Wetlands Biosphere Reserve, and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), in the states of Tabasco and Guanajuato.
- Write and review technical assessments to support legal resolutions product of enforcement activities related to fisheries, forestry, wildlife, environmental impact, and CITES.
- Coordinate and supervise field activities of 35 multi-level institutions and organizations (federal, state and municipal governments, academic institutions, private sector and NGO's) to determine the cause of death of aquatic fowl in Lake Yuriria, Guanajuato, and complete a final technical report of the investigation.

Assistant Director, (federal) Ministry of Agriculture and Hydraulic Resources (1993–1995).

Duties include:

- Participate in multi-sector work groups for 14 productive chains related to the agriculture, livestock and forestry, to analyse and reduce unnecessary government restrictions. This work was done in order to become more competitive in NAFTA.
- Research and elaborate diagnostic of the cotton, sugarcane and fructose, sheep and goat livestock sub-sectors; used to develop strategic plans in order to become more competitive in NAFTA.
- Participate in the negotiations between the federal government and fertilizer producing companies, to stabilize national prices after soaring international prices and mitigate the impact on the Mexican agricultural sector.
- Coordinate the activities of the National Milk Commission to establish import quotas to be auctioned in the national market to meet demands on a monthly and yearly basis, thus balancing demand and supply.

Conference Presentations

Silva Jimenez, L.F. (2012), *A shift from government to governance: Integrated Water Resource Management in the Lerma-Chapala Basin*. Canadian Association of Geographers: Annual Conference. University of Waterloo/Wilfrid Laurier University, Waterloo, Ontario.

Silva Jimenez, L.F. (2007), *Water Governance: New Issues or Old Problems*. Environmental Research Western: Colloquium. University of Western Ontario, London, Ontario.

Silva Jimenez, L.F. (2005), *Sustainable Water Resource Management: Capacity Building and Public Participation in the Lerma Chapala Basin, Mexico*. Canadian Association of Geographers: Annual Conference. University of Western Ontario, London, Ontario.

Silva Jimenez, L.F. (2005), *Gestión Sustentable de Recursos Hídricos: Desarrollo de Capacidades y Participación Social en la Cuenca Lerma Chapala, México*. International Hydrogeology and Water Resources Management Congress. Central American Water Resource Management Group. Managua, Nicaragua.

Silva Jimenez, L.F. (2003), *Sustainable Water Resource Management*. Canadian Association of Geographers Ontario Chapter: Annual Conference. Queens University. Kingston, Ontario.

Silva Jimenez, L.F. (2001), *Regional and Community Planning and Organization in the Purisima Basin*. 2nd International Scientific Congress of Hydrologic River Basins Management: Geocuenca II. University of Havana. Havana, Cuba.

Silva Jimenez, L.F. (2000), *Regional Planning and Public Participation: the Guanajuato Case Study*. 6th National Congress on Regional Development and 6th International Congress of Regional Sciences of the Pacific Basin. National Autonomous University of Mexico, Pacific Regional Science Conference Organization, Regional Science International Association, and Regional Development Science Association of Mexico. Mexico City, Mexico.

Article review

2009 Reviewed manuscript entitled “Water governance in the Oldman River basin: advancing the goal of aquatic ecosystem protection”. Canadian Geographer.

Relevant volunteer work

2007 Workshop facilitator and interpreter (English/Spanish): Field work in a Native American community (i.e., Raramuri) in the Sierra Tarahumara in northwestern Mexico. Workshop implementing a participatory approach to diagnose problems, identify possible solutions, and prioritize activities to elaborate a collaborative plan linked to ecosystem health, as part of the project “Eco-cultural Health in the Sierra Tarahumara”. February 12 to 16, Chihuahua, Mexico.

2006 Dialogue Event Facilitator: “Informed and Fair Water and Trade Futures: a dialogue about regional cooperation, development, and governance in upper Mekong region and the north-south economic corridor in 2025”. October 20-21, Chiang Mai, Thailand.

1991 Simultaneous translator (English – Spanish, Spanish – English) for the Elders Group in the “Indigenous Nations of the Americas International Conference: Strengthening the Spirit”. November 10-14, Ottawa-Hull, Quebec, Canada.