Is urban-water sustainability possible? Concepts, implementation, and barriers to enhance Integrated Urban Water Management in Mexico City

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Declaration of Authorship

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I, Fernanda García Alba Garciadiego confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

Abstract

Water scarcity and climate change events cause constraints in urban environments. Integrated Urban Water Management approaches have emerged to promote alternatives to urban water management and minimise such problems. These approaches have been facing reduced advances in been adopted. Literature has studied this phenomenon using Transition Theory. However, studies have barely focused on the cases when changes in the water systems are promoted by the actors of the existing dominant system (or incumbent-led transitions), while recognising the power and political dynamics in the developing world. This research addresses this gap by study two empirical projects in Mexico City that proposed a change in urban water management.

A framework adapted from the Transition Theory was used to clarify power dynamics in the water system in Mexico City, especially the role of actors in maintaining practices or deliver power to sustainable alternatives, represented by urban experiments. Also, this research recognises that the water system in Mexico City had already suffered some adjustments responding to external pressures that led to the introduction of sustainable practices. However, more work in the system structure and other domains (such as transport and conservation or resource management) is needed to make a significant change and introduce integrated approaches properly.

The main insights for this thesis are: (i) The recognition of the incumbents´ role in supporting alternative projects inconsistently as a response to regime´s external and internal pressures. (ii) Integrated approaches require a multi-regime integration. However, this is challenging due to the complexity of coordinating a large cohort of stakeholders that respond to reduce uncertainty and maintain diverse regimes´ visions, political-power structures and vested interest. (iii) Incumbents see multi-regime coordination as a risk, so they tend to compete and act in an antagonist manner to maintain resources and power, complicating socio-technical systems coordination. Finally, (iv) incumbent-led sustainable projects require a strict development design and evaluation fostering internal continuity, while external supervision is also required. Hence, the necessity of empowering external actors to the regime. The studied cases evidenced that sustainable projects represent another actor competing for resources, but struggles emerge in different scales and systems, recognising that a strict policy design from several domains is needed. Overall, this research shows that water management is difficult to modify due to the inherent complexity of the interconnected systems rather than a lack of will to change them.

Impact Statement

This thesis recognises opportunities and limitations for adopting Integrated Urban Water Management, specifically in Mexico City. The key research contributions of this thesis are:

Impacts on professional practice

i. This research illustrates specific local issues that act as barriers to sustainable approaches in water management in Mexico City. These issues can be considered in the design of future initiatives, likewise the recognised problems of alternative projects.

ii. This research recommends the implementation of policies that focus on supporting specific actions or short-term projects, while progressively supporting the introduction of long-term policies (i.e. comprehensive management plan). This should be accompanied by severe changes in the Mexican Policy towards creating a regional water management plan that aligns with other programmes and schemes from diverse socio-technical systems (i.e. transport).

iii. Objectives alignment and networks creation between different incumbents from various agencies and socio-technical systems are as important as testing experiments or Integrated Urban Water Management approaches. Thereby, this research recommends the design of a different mechanism to implement alternative projects that divert from standard practices.

Impacts on the research area

iv. This research complements incumbent-led transition studies while recognising the importance of power dynamics in the Transition Management process. Additionally, the focus on incumbents in the transition processes contributes to the *Inter-Regime Interaction* literature.

v. The thesis offers a theoretical framework for incumbent-led transitions and its adaptation for Mexico City case, representing a rich mixture of empirical and theoretical literature. Future research can use this framework and adapt it for particular circumstances.

vi. The thesis highlights the need for the following research in Mexico City: (a) To recognise the interactions between different socio-technical systems, which can be used to update the policy in water management. (b) To distinguish new negotiation spaces and mechanisms that allow niche-innovation creation, recognising the need for different and suitable learning evaluation methods for different stakeholders. (c) To review the water transition within a multi-scalar approach, understanding sustainable trajectories and recognising that sustainability is achieved through modifying the water system as other socio-technical systems at different scales and dimensions.

Dedication

This dissertation is dedicated to my father

Pascual García Alba Iduñate

"No me tienes que dar porque te quiera,
pues aunque lo que espero no esperara,
lo mismo que te quiero te quisiera."

Anonymous

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Glossary and definitions

ANP	Natural Protected Areas
AZP	Xochimilco, Tláhuac and Milpa Alta Heritage Zone Authority
Chinampa	An ancient technique that was highly used during the Aztecs times to create land over the ancient lakes. In the present days, it is used in the southeast parts of Mexico City as an agriculture system (Ezcurra *et al*., 1999).
Clientelism	Exchange of goods and services for political support and votes. However, this term is much broader and complex, as stated by Schröter (2010).
Comuneros	The person who owns common agrarian rights with other individuals or owners. This agrarian right has been recognised by a presidential resolution or the Agrarian Unitary Court.
Comisariado	The communal landowner or *ejido* commissioner is the person (or body) in charge of executing the agreements of the internal assembly and manage the *ejido*.
CONAGUA	National Water Commission. The national organisation of water resources management with technical, regulatory and consultative properties (CONAGUA, 2014b).
CONANP	National Commission of Natural Protected Areas
CORENA	Natural Resources Commission of Mexico City. This metropolitan agency executes programmes to manage and organise the protection, development and restoration of natural resources in the conservation zone (Lerner *et al*., 2018)
CORETT	Commission of Regularisation Land Tenure. This federal agency is responsible for expropriating *ejidos* or communal land and give land titles to settlers (Lerner *et al*., 2018).
Concession	An administrative term related to the Mexican Doctrine, which states the action that grants the management and exploitation of a public service or assets owned by the state to an individual.
CSO	Civil Society Organisation
Ejido	Land property right distributed to landless farmworkers, entitling communities or groups to use the land (usufruct). The Agrarian Laws allow farmworkers to use the land as a productive asset and for settlement (Pezzoli, 1998).
Ejidatarios	Communal landowners, peasants or farmers who occupy *ejidos* and communal land (Pezzoli, 1998).
GWP	Global Water Partnership
ICOMOS	International Council on Monuments and Sites
IMTA	Mexican Institute of Water Technology. This agency is responsible for water management research and technological development ("IMTA," 2015).
INAH	National Institute of Anthropology and History
IUWM	Integrated Urban Water Management
INE	National Institute of Ecology
IPN	National Polytechnic Institute
MLP	Multi-Level Perspective
NGO	Non-governmental organisation
PAOT	Environmental and Land Planning Attorney. This metropolitan public agency defends Mexico City inhabitants' right to enjoy a suitable environment, promoting and monitoring agreements on environmental matters and land use (Lerner *et al*., 2018).
Patronage	Exchange relationship in which access to public employment is traded for political support or loyalty (Armesto & Olmeda, 2018).
PROFEPA	Environmental Protection Federal Attorney

PUEC	University Programme of Studies on the City
PUEM	University Programme of Metropolitan Studies
PUX	Project UNESCO-Xochimilco
RAMSAR	The inter-governmental conventions of wetlands, which was first established in the city of Ramsar, Iran in 1971. This convention established a national action and international cooperation framework to maintain and rationally used wetlands and its natural resources (CONAGUA, 2014a).
RAN	National Agrarian Registry. This federal agency approves land-use plans in ejidos and communal land properties and registers decisions to privatise this land (Lerner *et al.*, 2018).
REC	Community Ecological Reserve
RM	Acronym for Magdalena Restoration
SACMEX	Mexico City's Water Department. This agency is responsible for operating hydraulic infrastructure and the provision of the following services: supply fresh water, sewerage, water treatment and reuse of wastewater. Also, it develops studies, projects and works related to the water sector in Mexico City (SACMEX, 2010).
SARH	Agriculture and Hydraulic Resource Ministry
SEDUVI	Ministry of Urban Development and Housing. Metropolitan agency that approves municipal urban development plans, as well as land-use changes in regularisation commissions (Lerner *et al.*, 2018).
SEDESOL	Ministry of Social Development
SEMARNAT	National Ministry of Environment
SEDEMA (SMA)	Ministry of Environment in Mexico City. This metropolitan agency leads recuperation of ecological zones and leads studies of environmental impacts in regularisation commissions (Lerner *et al.*, 2018).
SEDEREC	Ministry of Rural Development and Equity for Rural Communities. Metropolitan agency that it is currently known as the Ministry of Native Towns. Neighbourhoods and Resident Indigenous Communities (SEPI)
SETRAVI	Ministry of Transportation and Roads of the Federal District
SIRCHAL	International Seminar on the Revitalisation of Historic Centres of Latin America and the Caribbean
TM	Transition Management
UAM	Metropolitan Autonomous University
UNAM	National Autonomous University of Mexico
UNESCO	Cultural Heritage Site and United Nations Educational, Scientific and Cultural Organisation
WHC	World Heritage Committee
WSS	Water Supply and Sanitation Services

Chapter one

1 Introduction

1.1 Background and Motivation

Centralised water supply and sanitation services (WSS) have been criticised for implementing the traditional "*take, use and waste"* linear approach (Novotny, 2013) and their incapability for dealing with unsustainable rates of urban water demands that expect to increase by 40% before 2030 (Water Resource Group, 2009: 40), and climate change uncertainties (Chanan, Vigneswaran, & Kandasamy, 2010; Chocat *et al.*, 2007; de Haan *et al.,* 2011; Deak & Bucht, 2011; Koop & Van-Leeuwen, 2017; Pearson *et al.*, 2010; White, 2010). Approximately 1.4 billion people live in urban areas around the world and are exposed to more intense seasonal floods and droughts related to climate change phenomena (Chelleri, Schuetze & Salvati, 2015: 123).

The adoption of sustainable urban water management practices is an urgent matter. Terms and concepts such as *Best Management Practices*, *Low Impact Development*, *Water Sensitive Urban Design*, *Integrated Urban Water Management* or *Integrated Water Resource Management* have emerged to deal with water through different mechanisms. These approaches range from those that deal with run-off pollution to those that embrace an integrated approach (Fletcher *et al.*, 2014). Integrated approaches involve effective and efficient water resources and services management. The coordination of institutional, financial and political structures that are commonly managed separately, such as water supply, drainage and sewer systems (Jensen & Nair, 2019; Rodda, 2009; Williams, 2019). However, these alternatives are far from being a worldwide mainstream practice. Reasons for these limitations lie within multiple implementation barriers, related to differences and conflicts in defining water problems and solutions, inadequate governance structures, ineffective institutions and regulatory mechanisms. A series of limitations that exist in developed and developing countries (Brown & Farrelly, 2009; Castro, 2007; Cettner *et al.,* 2012; Chocat *et al.*, 2007; Rodda, 2009; Sharma *et al.,* 2012). Thereby, it is necessary to understand the limitations of these options to overcome them and facilitate the adoption of integrated approaches.

1.2 Research Problem and Gap

The difficulties of changing water management practices related to centralised WSS has been broadly studied in the Sustainable Transition Theory literature (Brown, 2005; Brown, Farrelly & Loorbach, 2013; Brown, Keath & Wong, 2009; Fuenfschilling & Truffer, 2014; Sharma *et al.*, 2012; Sussams, Sheate & Eales, 2015). Sustainable transitions have been defined as "*when the interactions between forces and factors at the different scales enable a restructuring and destabilisation of an (established system´s) rules and relationships in a manner that increases socioeconomic well-being and reduces environmental degradation"* (Rock *et al.*, 2009: 242).

Transition involves a major transformation in societal functions, such as in provision and mobilisation of resources (goods, knowledge, technology and people) to fulfil specific needs of the population (Berkhout *et al.*, 2010). They are a matter of governance or coordinating resources, interactions and power to create markets, design policies, organising agencies and aligning visions to transform established dominant socio-technical systems that fulfil societal needs (i.e. centralised and piped water system), also known as regimes (Arapostathis *et al.*, 2013; Smith, Stirling & Berkhout, 2005). Therefore, transitions require a series of changes in several domains, such as in policy (Genus & Nor, 2007; Tong & Yan, 2013), institutional arrangements (Jolly & Raven, 2015), market and users (Fouquet, 2016), and power distribution (Lawhon, 2012) among others.

Tracing power is gaining recognition in academic research to understand transitions dynamics (Avelino & Rotmans, 2011; Avelino & Wittmayer, 2016; Smink, Hekkert & Negro, 2015). However, there is a gap in studying the power dynamics in water management when the actors of the dominant socio-technical system promote innovations, alternative projects, experiments or *incumbent-led transitions* while considering the political background. First, this theory has been severely criticised for overlooking power and political factors (Lawhon & Murphy, 2011; Meadowcroft, 2011; Shove & Walker, 2007). Second, power dynamics between regime-projects has been studied through understanding the strategies (or power) displayed by the regime´s actors when facing pressures from innovations (Hopkins & Schwanen, 2018; Stenzel & Frenzel, 2008). However, most studies concentrate on economic and policy-making activities, failing to consider further how transitions are interlaced with political and other influences, especially in water management. Also, recent literature emphasises the limitations of translating this theoretical framework outside Europe (Hansen *et al.*, 2017; Ramos-Mejía, Franco-Garcia & Jauregui-Becker, 2018) due to the behavioural differences between regimes in different locations, especially in developed and developing countries (Hamann & April, 2013; Raven, Schot & Berkhout, 2012). The literature recommends revising the theory and developing it in a manner to make it geographically sensitive (Hansen & Coenen, 2015) and address the local differences that exist in diverse settings (Ferrier, Jenkins & Blackstock, 2009; Neto, 2016; Shuster & Garmestani, 2015; van de Meene, Brown & Farrelly, 2011).

This research takes Mexico City, in Mexico, as a case study to illustrates a series of problems related to deficient water governance or inadequate resource management (Castro, 2007). This city has been

considered as a *water-scarce* region as a significant proportion of water consumption (173%) surpasses the renewable water resources locally available (mainly groundwater)(Carabias & Landa, 2005; Comisión Nacional de Agua, 2011; Swyngedouw, 2004). This consumption is expected to reach 226% of water overexploitation by 2030 (United Nations Water Stress Classification referenced in Chelleri *et al.*, 2015: 124). The over-exploitation of internal resources has created secondary problems, such as severe subsidence and damage in the urban infrastructure (Adler, 2011; Carrera-Hernández & Gaskin, 2008).

Rainwater is not used despite the average annual precipitation exceeding 750mm (Adler, 2011: 94), and increasing flood risks as the drainage system average load reach 210 m^3/s (Izazola, 2001: 288; Sosa-Rodriguez, 2010). The sewer system regularly fails as infrastructure easily collapses due to disposable water continue increasing related to continuing population growth, increasing pavement infrastructure and more run-off (Castro-Reguera, 2014). These problems have pushed the limits of Mexico City water system outside of the metropolitan border while conveying water from and to external basins, which represents a large portion of the national budget (Ezcurra *et al.*, 1999; Tortajada, 2006). Tortajada & Castelán (2003) estimate that about 20% of the energy that is produced at the national level is used to pump water in and out of Mexico City. This has created high social, economic and environmental impacts in the broader region (Delgado-Ramos, 2015; Fuentes & Sosa, 2015; Peña-Garcia, 2012).

Policies, consumption behaviours, power structures, social arrangements and the existing infrastructure play a fundamental role in maintaining the system (Castro, 2006; Perló-Cohen & González-Reynoso, 2006; Tellman *et al.*, 2018). These arrangements have locked-in alternatives or what Raven, Bosch & Weterings (2010) define as a systematic resistance from social, institutional and technological structures. This is reinforced by the lack of integrated vision on managing water, which has created the false expectation that the problems can be solely solved from a technical or political point of view, producing limited results (Jiménez-Cisneros & Torregrosa-Armentia, 2007: 163). Some drivers are pushing for changes in water management, and this is reflected in the diverse policies (Akhmouch, 2012; Martinez & Bandala, 2015). However, the system and related actors seem reluctant to change (Caraballo, 2006; Legorreta, 2005, 2013) and instead it is proposed to continue bringing water from further areas, expanding the system border and creating more conflicts related to water availability (Delgado-Ramos, 2015; Fuentes & Sosa, 2015). Hence, it would be recommendable to see why changes have been limited in this city.

1.3 Rationale

This research investigates whether there can be a transition in the water management of Mexico City and the role of the water system in such *evolution*. A theoretical framework was proposed building on Transition Management (Loorbach, 2010) and the alignments and processes of the socio-technical regime (Geels, 2011; Smith & Raven, 2012) to understand water system and related actors´ reactions to proposed changes in the form of experiments. This framework considers the local and political background to understand the complex and heterogeneous water system in an intricate context. Also,

this framework is based on what the existing literature tells about the water system of Mexico City while analysing experiments or projects that have proposed the introduction of alternative approaches aligned to Integrated Urban Water Management to comprehend the transition. This research uses case studies and a qualitative approach to illustrate the water management of Mexico City, its governance and the variables that restrict or encourages the changes on it. The information was gathered through in-depth semi-structured interviews and triangulated with document analysis (newspaper articles and academic papers) and field observations.

Case studies

This thesis uses two implemented projects to illustrate the use of the framework: the Magdalena River Restoration Project and the Project UNESCO-Xochimilco (PUX), which reached certain momentum and passed through the implementation phase. These two projects were proposed for the conservation of two water elements: the Magdalena River and Xochimilco wetlands, aiming to protect surface water as an asset (environment or heritage value). Also, they both are located in the southern border or peri-urban area of Mexico City as it is shown in Figure 1.1; so they share similar contextual characteristics.

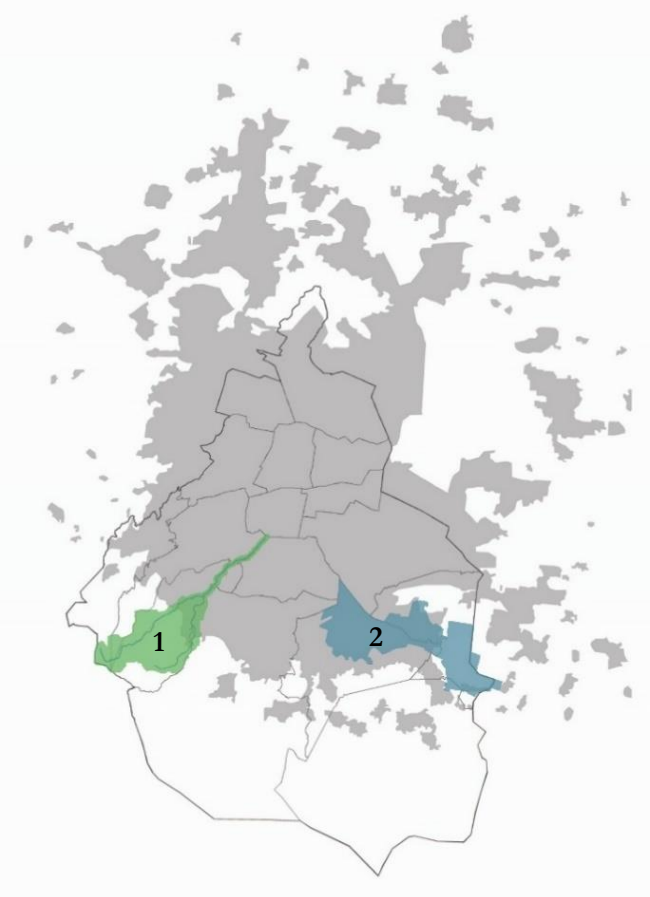

Figure 1.1.Location of the two case studies in Mexico City
1) Magdalena upper basin and river, and 2) UNESCO Heritage site of Xochimilco, Tláhuac and Milpa Alta.

1. The Magdalena River is claimed as the only living river in Mexico City (Reforma-Staff, 2007a). However, this river is highly polluted with domestic waste from informal settlements that have been established in the river banks. Part of it has been channelled and converted into a road (UNAM, 2009). Following the flourishing trend in the 1990s of urban river restoration, the idea of restoring this river gained support, and the Mexico City Mayor eventually adopted it in 2007 (Reforma-Staff, 2007b). This led the city government to hire a university to design a restoration project focusing on the river's natural ecosystem and based on community participation (González-Reynoso *et al.*, 2010; Zamora-Sáenz, 2013).
2. The remaining parts of an ancient lake survive in Xochimilco and Tláhuac Municipalities (Revollo-Fernández, 2015a). However, this wetland is in a precarious condition as the local springs and aquifer have been over-exploited, affecting surface water availability in this area (Angeles-Serrano, Perevochtchikova & Carrillo-Rivera, 2008; Gonzalez-Pozo *et al.*, 2016). Neither the status of the area as UNESCO World´s Heritage Site (Arizaga-Guzman, 2002) nor repeated attempts to reverse its condition, have stopped the degradation (Gonzalez-Pozo *et al.*, 2010; Legorreta, 2005). In the 2000s, concerns about Xochimilco were presented to UNESCO, which agreed with the municipal government to design a participatory Management Plan to guarantee this site´s conservation (Caraballo, 2006).

1.4 Research question, aims and objectives

Transition to sustainable approaches is difficult to achieve in developed and developing countries (Bahri, 2012; Chocat *et al.*, 2007; Sharma *et al.*, 2012). However, there is no blueprint solution to address all urban water problems (Ostrom & Cox, 2010). Changes in well-established water systems require a considerable deliberation of the local characteristics where it is going to be implemented (Mostert, 2009). Mexico City has inadequate water management and strong resistance to change. Every time a project emerges, it continues proposing technical solutions without really understanding that the problem is interwoven with social, institutional and political variables highly embedded in the regime. Hence, this research aims to improve the understanding of the existing water system and the possibilities to change it by answering the following research question:

How do urban water systems and related actors respond to transition pressures towards sustainable and integrated approaches, especially in developing countries?

The following sub-questions support this question:

1. What is the role of regime-led experiments in responding to transition pressures?
2. What are the main challenges that regime´s actors or incumbents face in changing the regime´s practices and introducing IUWM approaches?
3. Do incumbent or regime-led sustainable initiatives contribute towards creating a transition trajectory and the creation of niche- innovations?

The scope of the study is the water system (as a regime), incumbents (regime´s actors) and their role in inducing changes, especially as these actors make evident the political nature of transitions. The main contribution is the adaptation of a theoretical framework to understand the dynamics that face and produce the main actors in Mexico City´s water management in order to provide integrated-sustainable approaches. Additionally, this research contributes to the knowledge field in transitions in developing countries, multi-regimes interaction, the role of incumbents in sustainability evolution and urban water management.

1.5 Thesis Outline

This thesis illustrates the advances and resistances in changing water management in Mexico City through nine chapters. Chapter 1 introduces Mexico City and why it is suitable case-study, while highlighting the rationale of this research. Chapter 2 reviews key concepts and methods used for introducing sustainable alternatives in urban water management and the main limitations faced by such approaches. This chapter illustrates the complexity of transitions in water management in the developing world. Chapter 3 describes the methodology, delivering an explanation of the methods used to gather the information and the analysis performed. This chapter indicates that this is inductive research and that the framework was adapted to explain the data. Chapter 4 details the theoretical framework used and how it emerged from Transition Theory, detailing notions from the Multi-Level Perspective and Transition Management. Chapter 5 illustrates Mexico City´s water system using the existing literature and the Multi-Level Perspective, finding local particularities to adapt the framework. Then, the studied cases and results are presented. The Magdalena River Restoration is described in Chapter 6 and the Project UNESCO-Xochimilco in Chapter 7. These two chapters describe sustainable projects that proposed a change in water management, including the data revised through the theoretical framework. Chapter 8 compares the two cases and discusses the main findings, unravelling transition trajectories in water management in Mexico City and distinguishing the contribution to knowledge. Chapter 9 presents the conclusions of the main findings, highlighting the main problems and consequences of the incumbent (regime actor)-induce transition in Mexico City. The aim to comprehend how to strengthen transitions in this city and water systems transformations around the world. Additionally, this chapter proposes future research to extend the contributions of this thesis.

Chapter two

2 Urban Water Management and Transitions

Water scarcity and events related to climate change have been pushing for the introduction of alternative strategies in urban water management. More consideration is needed in water management transitions in the developing world and the role of the dominant socio-technical system in such change. However, the alternative approaches are difficult to introduce in a practical world due to a series of limitations that are described in this chapter. Section 2.1 presents the problems of centralised and piped urban water services and introduces alternative practices that have been reconsidering in the urban domain. The limitation of introducing alternatives are discussed in Section 2.2. Also, other variables that influence transition in water management, such as the political context and the complex settings are discussed in Section 2.3 and 2.4. This chapter finalises with a summary in Section 2.5.

2.1 Water in the cities and alternative water management approaches

Centralised and piped water supply and sanitation services emerged to promote health and to reduce flood risk, but have become inadequate to deal with current challenges (Butler & Davies, 2011; White, 2010). These services have received criticism as they encourage an increasing resources exploitation and the construction of large dams and water diversion projects that have seriously harmed ecosystems, altering water chemistry and nutrient flows while using a significant amount of energy and economic resources (Clark & Hakim, 2014; Kaika, 2005; Mitchell, 2006). These services have contributed to the water scarcity in some urban settlements (Pearson *et al.*, 2010). Following the "*take, make or waste"* line of natural resource consumption (Novotny, 2013), centralised services have encouraged an inappropriate resource consumption and inadequate water management, as commonly domestic and industrial wastewater is mixed with rainwater, increasing the cost of treating it (Butler & Parkins, 1997; Zambrano, 2010). Also, these services have created a series of problems to the hydrological cycle within the urbanisation process (Satterthwaite, 2011; van-der-Heijden, 2014). Figure 2.1 shows the altered water cycle in the urban setting, illustrating that water run-off becomes 45% higher in impervious areas compared to the natural areas, where 50% of rain infiltrates into the subsoil. The problem involves urban run-off collecting oil, grease, de-icing substances, cleaning products, dust and chemicals, among others. In some cases, it enters into aquatic ecosystems causing considerable environmental harm and increasing the treatment costs for future consumption (Austin, 2014; Chin, 2006; Pazwash, 2011; Zambrano, 2010).

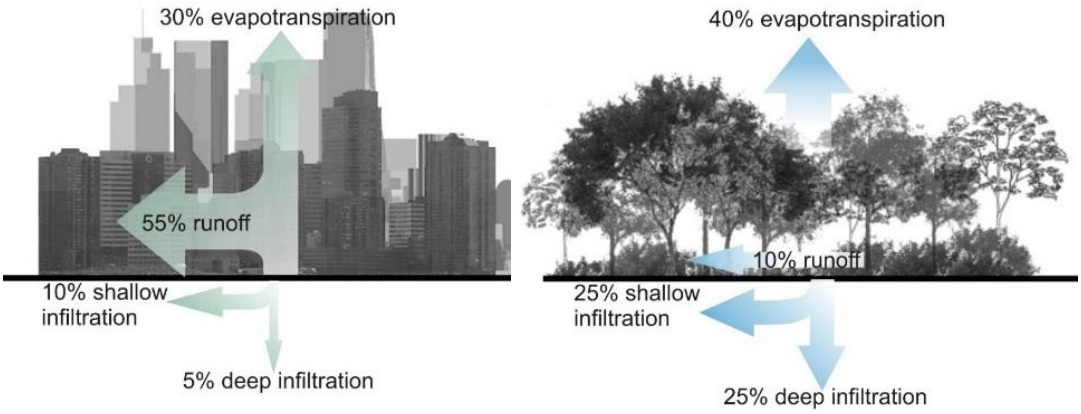

Figure 2.1 Diagram of urban and natural water run-off.
Adapted from US Environmental Protection Agency (2008). Source: Pazwash (2011: 2).

Cities became reliant on a costly central structure that provides water and sanitation services through networks of buried pipes (Speers, 2009 referenced by Marlow *et al.*, 2013; Zambrano, 2010). However, the continuing growth in demand for water supply and disposal from the expanding urban settlements, ageing infrastructure and water stress (or scarcity) are challenging this water system model (Brown *et al.*, 2009; Butler & Davies, 2011; Butler & Parkins, 1997; Chanan *et al.*, 2010; Lundy *et al.*, 2013; Marlow *et*

al., 2013; Niemczynowicz, 1999; Pazwash, 2011). This topic requires urgent reconsideration as urbanisation increases globally, and cities will consume more water (from a combination of population growth and the increment of per-capita consumption, as described by Satterthwaite, 2011). Currently, 55% of the world's population lives in cities, and this number is expected to increase to 68% by 2050, with the fastest growth rates in developing countries (Chelleri *et al.*, 2015; United-Nations, 2018a, 2018b).

Also, cities encounter challenges due to extreme events related to climate change (Zhou *et al.*, 2013). Climate change has increased awareness about urban risk as more than half of the world's population live in cities, and they are the primary recipient of related threats (United-Nations, 2014; White, 2010). An example of the challenge that urban areas face is an increase in droughts or rainfall. In the case of drought, there would be disruptions of water supply, which would eventually damage the infrastructure and its capacity to provide services, affecting the viability of urban centres (Bahri, 2012). Heavy precipitation events increase flood risks due to incapacity of the drainage systems to deal with increasing volumes of water, leading to the discharge of untreated wastewater into watercourses and disturbing aquatic ecosystems (Deak & Bucht, 2011; Jones & Macdonald, 2007; Marlow *et al.*, 2013).

Water management in the cities is facing complex problems that require more than simple solutions. Currently, there are examples of alternative approaches attempting to deal with urban water management complexities. Some countries have adopted methods to manage urban water-related problems, mainly to deal with water pollution and urban drainage. These principles vary by location, scope and objectives, as described by Fletcher *et al.* (2014) and represented in Figure 2.2.

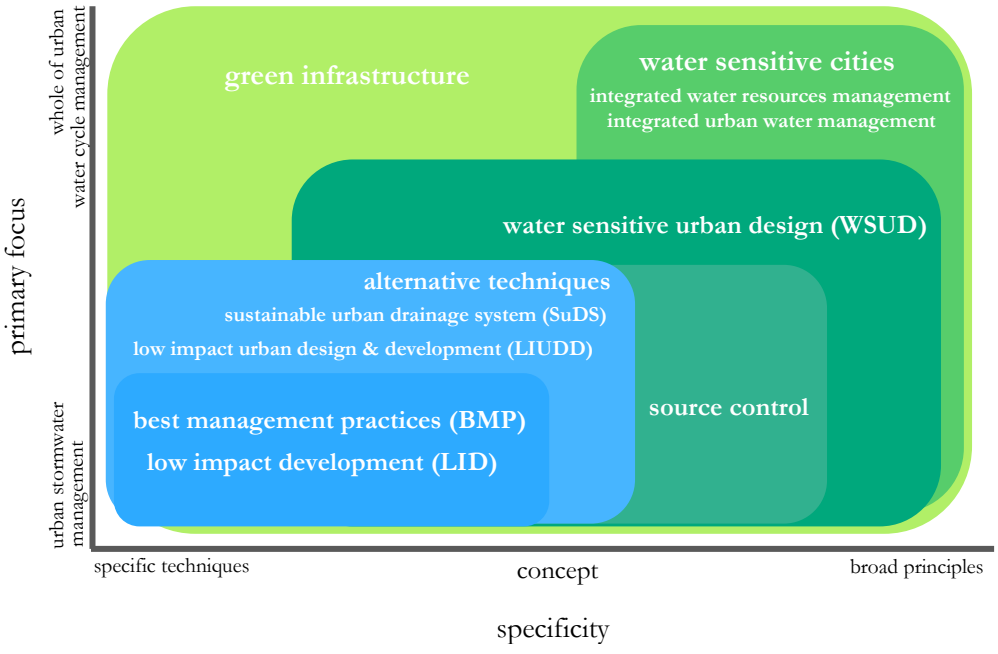

Figure 2.2 Water management and urban drainage terminology classification
According to their specificity and their primary focus. Source: Fletcher *et al.* (2014)

Figure 2.2 represents how alternative water management concepts evolve from basic objectives of dealing with run-off pollution to integrated approaches. Fletcher *et al.* (2014) state that the most basic approach comprises a group of measures, prohibitions and maintenance procedures to prevent water pollution, as *Best Management Practices (BMP)*. Then, more complex approaches use interconnected soft engineering techniques that improve water quality, as *Sustainable Urban Drainage Systems* (CIRIA, 2007; Fletcher *et al.*, 2014). More comprehensive approaches involve broader objectives and approaches, even linking landscape, policy and technology with water (Novotny, 2013), incorporating philosophical attitudes and behavioural consumption changes, through recycling and rainwater harvesting schemes (Sharma *et al.*, 2012). Fletcher *et al.* (2014) point out that *Water Sensitive Urban Design* involves urban design to minimise urban impacts on the natural environment, mimicking the natural water cycle, including every part of the water cycle and promoting liveability services through specific flow control strategies (rain gardens, wetlands and swales) (Fletcher *et al.*, 2014; Furlong *et al.*, 2017; Russo, Alfredo & Fisher, 2014). These approaches are briefly described in Table 2.1.

Table 2.1 Water management alternative approaches and urban drainage terminology description

Name	Place of Origin	Description	Reference
Best Management Practices (BMP)	USA and Canada	On-site pollution prevention activities and measures to preserve natural areas. This approach is a guideline to conserve natural resources (including water) and planning practices to eliminate wildfire risk, control insects and diseases, and reduce potential erosion, among other activities. BMP proposes a series of recommendations, such as wetland protection measures to minimise disturbances and activities to control polluted run-off from entering to water bodies.	Brooks, Folliott & Magner, 2013; Fletcher *et al.*, 2014.
Low Impact Development (LID)	USA and Canada	The object of this approach is to minimise the cost of managing stormwater or run-off through a natural approach design and integrated control measures. LID protects valuable zones (aquifer recharge and waterways) through just allowing low impact developments	Fletcher *et al.*, 2014.
Sustainable (urban) drainage systems (SUDS/SuDS)	United Kingdom	A series of interconnected techniques (management train) that allow water quality and quantity to be infiltrated into the ground or be stored sustainably. This system replicates the natural drainage prior to urban development.	Fletcher *et al.*, 2014; Thames 21 and UCL, 2013.
Alternative techniques (ATs)	French-speaking countries	This approach focuses on solving drainage and pollution problems, through reducing run-off volume, peak flows and flooding risk. ATs uses stormwater management corridors to optimise land use and reduce negative effects of urbanisation.	Fletcher *et al.*, 2014.
Low Impact Urban Design & Development (LIUDD)	New Zealand	This approach is based primarily on preventing pollution. It also gives significant consideration to the ecosystem health, clean energy and the Maori culture significance over the environment.	Fletcher *et al.*, 2014.

Continue…

Continuation Table 2.1

Name	Place of Origin	Description Reference	Reference
Water Sensitive Urban Design WSUD	Australia	WSUD main objective is to use water as a potential benefit enhancing its quality and quantity. This approach links water and urban design, minimising the impacts of urban development in the water cycle. Thereby uses the urban landscape to mimic the natural hydrological cycle (retaining, harvesting, reusing and letting water to infiltrate into soils) while creating recreational opportunities. WSUD restores and protects water bodies through considering the whole water cycle (supply, sewerage and stormwater), using alternative sources or a fit-for-purpose and dealing with water scarcity and water excess.	Bell, 2015; Coutts *et al.,* 2012; Fletcher *et al.*, 2014; Lundy *et al.*, 2013; Sharma *et al.*, 2012; Wong & Brown, 2009.
Water Sensitive City (WSC)	Australia	This aspiring approach perceives the city as a water supply catchment. Thereby, it proposes a wide range and flexible accesses to water sources (rain harvest, water reuse, etc.) and an adaptive and multi-functional infrastructure (a mix of centralised and decentralised infrastructure), through urban planning. This approach aims to optimise the use of water resources within a city and reduce the imports and exports of external resources. WSC is also a philosophical approach as it involves the collaboration between science, policy, practice and community in the decision making. Thereby, it implicates the active participation of the community (Water Sensitive Communities) having water-sensitive behaviours.	Ferguson, Frantzeskaki & Brown, 2013; Wong & Brown, 2009.
Integrated Urban Water Management (IUWM)		This is a comprehensive process that maximises the efficient and sustainable management of water resources coordinating agencies, organisations and urban water services. This process promotes urban water services as an integrated physical system, dealing with water scarcity and introducing a balance between human and environmental needs. Thus, it refers to a series of principles that aim to manage water as part of the whole natural water cycle through diversification of local sources and fit for purpose practices.	Clark & Hakim, 2014; Grit *et al.,* 2015; Marlow *et al.*, 2013; Mitchell, 2006; Petry & Dombrowsky, 2015.
Integrated Water Resources Management (IWRM)		IWRM promotes the protection of the whole system at the basin level while including the spatial integration of all the water resources and their natural functions. This is done to achieve water security, preserving water sources and safeguarding the drinking water supply. It focuses on dealing effectively with both water resources and human activities through the integration of diverse sectors.	Feldman, 2007a; Heathcote, 2009; Marlow *et al.*, 2013; Petry & Dombrowsky, 2015.
Green Infrastructure (GI)	United States of America	GI focuses on creating a network of green hubs and corridors (while maintaining healthy waters). This approach combines socio-ecological processes with urban planning to encourage a series of benefits, like ecosystem services, biodiversity conservation, climate change adaptation, human well-being and social equity.	Fletcher *et al.*, 2014; Sussams *et al.*, 2015; Young *et al.,* 2014.

Green Infrastructure is described by Fletcher *et al.* (2014) as the most comprehensive terminology, but simultaneously it has been widely used to described interconnected networks of multi-functional green areas that facilitate environmental services (Kandulu, Connor & MacDonald, 2014; Molnar &

Kubiszewski, 2012; Schäffler & Swilling, 2013). Other authors such as Blau, Luz & Panagopoulos (2018) use this term because it involves sustainable benefits from all the urban systems (biodiversity, energy, transport and food, among others) and not just from the water management point of view. Hence, this term can create confusion as it is used to describe the creation of green spaces to control run-off or to involve benefits outside the water system, but weakly defines the institutional and societal domains of water management. Therefore, this research takes the term of Integrated Urban Water Management (IUWM), a term that Fletcher *et al.* (2014) describe as the equal term to Water Sensitive City.

Different countries experience different levels of alternative practice adoption, and better advances have been experienced in developed countries and some cases in Asia (Chan *et al.*, 2018; Chen, Maksimovic & Voulvoulis, 2011; Jensen & Nair, 2019). Although Brown (2012) describes that these countries are just experiencing a *waterways approach* that focuses on environmental protection and pollution management, as there is still a long trajectory to achieve integrated approaches (Brown *et al.*, 2009 found in de Haan *et al.,* 2015). Meanwhile, a considerable number of developing countries tend to focus on the planning of alternative approaches, as they recognise significant limitations in the implementation of these due to their intricate context (Bahri, 2012; Grit *et al.*, 2015; Sletto, Tabory & Strickler, 2019). Still, the main limitations in introducing sustainable alternatives in water management tend to be similar around the world.

2.2 Limitations towards alternative approaches

The gap between alternative practices design and their implementation is already a topic of concern for sustainability researchers (Gaube, Haberl & Erb, 2013; Quitzau, Hoffmann & Elle, 2012), receiving considerable attention from researchers who methodologically study the factors that affect the implementation of such practices (Ahiablame, Engel & Chaubey, 2013; Bos, Brown & Farrelly, 2013; Cettner *et al.*, 2012; Chocat *et al.*, 2007; Farrelly & Brown, 2013; Fuenfschilling & Truffer, 2014; Grit *et al.*, 2015; Marlow *et al.*, 2013).

Integrated Water Management approaches can be challenging to implement as they involve a considerable range of uncertainties, complexities and long-term commitments (Grant, 2016; Sharma *et al.*, 2012). Sharma *et al.* (2012) through a series of interviews and online surveys with water practitioners, utilities and other stakeholders in Australia, concluded eight main impediments towards the implementation of sustainable water management approaches. This can be complemented with the work of Brown & Farrelly (2009) that allocated twelve limitations, and the work of Chocat *et al.* (2007), which states that most of these can fall into two categories: (1) low diffusion and lack of knowledge about alternative practices, and (2) absence of institutional capacity or the ability to manage organisations and activities to achieve alternative approaches (Polk, 2011). The main limitations are summarised in Table 2.2.

Table 2.2 Limitations related to the institutional capability and knowledge about alternatives

Category	Limitations
Poor knowledge and diffusion	Inadequate skills and knowledge across industry sectors. This is reinforced by the poor communication between sectors
	Lack of knowledge related to innovative water management.
	Low evaluation, performance and monitoring, due to the limited information about the performance of innovative water management systems.
Lack of institutional capacity	Governance and policy structures are not sufficiently flexible to allow sustainable water approaches and management
	Different jurisdictions and government levels show inconsistencies among them, limiting innovation implementation.
	No financial incentives. There is no investment for further works as the benefits of innovations are not recognised.
	Poor organisational commitment
	No long-term strategies
	Blurred-fragmented definition of responsibilities and roles. Poor planning, operation and management

Brown & Farrelly (2009) and Sharma *et al.* (2012) point out that the other barriers relate to the political and social domain, such as the lack of political motivation in embracing alternative methods and limited involvement of the community, as well as impacts and difficulties arising from external events and path dependency related to the existing technology.

Concepts in Table 2.2 are interrelated as a result of the dependence on institutions or industry that can induce the adoption of alternative practices and the lack of skills and knowledge across industry areas, which compromises the industrial sector capability to operate and manage alternative approaches. Here, the absence of knowledge mostly affects the possibility of defining the problems related to water and the possibility of defining an integrated strategy to solve such problems (Sussams *et al.*, 2015; Young *et al.*, 2014). Furthermore, there are considerable knowledge gaps about planning, design, implementation, operation and management (Sharma *et al.*, 2010 referenced in Furlong *et al.*, 2017). These knowledge gaps limit the perception of possible benefits of alternative practices (Farrelly & Brown, 2013), such as the possibility of improving urban ecological conditions (Karvonen & Yocom, 2011). Eventually, this lack of knowledge restricts the possibility for these approaches to be assessed, which would produce more information about them (Chocat *et al.*, 2007), and thus limits the political desire to implement these alternatives (Ahiablame *et al.*, 2013).

Some empirical cases have proven that institutional capability and the institutionalisation of alternative principles are vital factors in the successful implementation of IUWM approaches. China and Hong Kong have achieved a remarkable improvement in introducing alternative approaches (Chan *et al.*, 2018; Jensen & Nair, 2019; Wang *et al.*, 2018). Singapore has improved and diversified its water supply, eliminating administrative barriers in water management and delegating the responsibilities and all the aspects of the urban water cycle (supply, sewerage and drainage) to a single agency, the Public Utilities Board (PUB) (Chen *et al.*, 2011; Jensen & Nair, 2019). However, it is important to remember that China and Singapore do not have a democratic governmental structure, which may be an important factor in

the implementation of alternative practices, so more research is needed. Additionally, such achieved success should be taken cautiously as it is too early to know if these countries have fully achieved the intended comprehensive goals (Lim & Lu, 2016; Zevenbergen, Fu & Pathirana, 2018).

However, in most of the countries, the inertia in the institutional domain continues to be one of the main factors in restricting urban water management transitions (Brown & Farrelly, 2009; Mitchell, 2006; Morison & Brown, 2011; Mostert, 2009; Rodda, 2009; Ryan, 2010). This is the case of the Netherlands. Despite having IWRM projects around the nation, this country has failed to create supporting institutional arrangements due to overlapping competencies of a large number of authorities and different organisation procedures (Mostert, 2009; Stead, 2014). Something similar occurs in Australia, where the discoordination between sub-regional levels (the ones that develop IUWM plans) and the local-metropolitan levels (the ones that approve or dismiss projects, i.e. treatment plants) reduce the possibilities of introducing alternatives while highlighting the lack of consistency between plans and strategies from different scales (Furlong *et al.,* 2016a). This is reinforced by a tendency to not have a comprehensive national or regional vision that includes alternative approaches (Ferrier *et al.*, 2009).

Researchers and practitioners have come to the idea of standardising the implementation of IUWM approach to diminish the problems that emerge through the design and implementation process (Furlong *et al.*, 2017; Grit *et al.*, 2015; Mitchell, 2006; Morandi *et al.*, 2014; Morison & Brown, 2011). First, it has been recognised that alternative projects (design baseline and objectives) tend to scatter throughout the implementation process unless they are accompanied by guidelines, standards, and regulations, that eventually contribute to the design of monitoring and evaluation systems that measure whether the projects have achieved the proposed goals (Mitchell, 2006). Second, a systematised planning strategy provides a valid method or a rigorous assessment for alternative approaches, increasing the credibility of the project as they are based on reliable data instead of general beliefs (Furlong *et al.*, 2017; 2016a). Third, a protocol can reduce the complexity that relates to the IUWM planning process, as a result of the large number of stakeholders involved, the lack of experience and unpredicted outcomes from flawed financial estimations or inconsistent financial evaluation methods (Furlong *et al.*, 2016a). Additionally, a homogeneous planning and implementation process can regulate different projects, facilitating the evaluation of outcomes and the diagnosis of the processes at a national scale (Furlong *et al.*, 2017; Mitchell, 2006; Morison & Brown, 2011).

This standardisation has not been fully applied in practical cases or issued in guiding principles (Grit *et al.*, 2015). However, it has been recognised that alternative approaches (such as IUWM or IRWM) need a different planning tactic compared to the traditional approaches. Firstly, a problem should be defined through involving concerns of stakeholders and developing a joint vision, identifying several options of alternative infrastructure or potential solutions for such problem, and selecting an acceptable option through a methodological assessment (Furlong *et al.*, 2017). Additionally, the Global Water Partnership Technical Advisory Committee (GWPTAC referenced in Ferrier *et al.*, 2009) recommends a roadmap

that sets out a series of external pre-conditions at a national level, which should be assessed in a first evaluation stage (Hossain & Bahauddin, 2013). These conditions are:

1) Enable the environment or establish a legal framework
2) Create a mechanism to create institutional capacity that defines a precise distribution of responsibilities and coordination patterns
3) Set management instruments that involve regulatory, economic, information and communication tools, as social change mechanisms for conflict resolution and demand management

The lack of proper protocol has been pointed out as a problem, even in countries where the implementation of alternative approaches seem to be advancing. According to Zevenbergen *et al.* (2018), this is the case of China´s ambitious Sponge City Programme, where implementation is performed within the traditional approaches´ standards, and reinforces that the water cycle continues to be managed in a divided and segmented manner. Additionally, this top-down approach presents a series of problems, especially in knowing how to implement the urban-drainage infrastructure and evaluate the outcomes, thus obstructing the achievement of ecological health, sustainable goals and public engagement (Chan *et al.*, 2018; Dai *et al.,* 2018; Wang *et al.*, 2018).

Having a protocol or an implementation process can ease some problems, as it can induce some new patterns and behaviours. However, and returning to Table 2.2, the limitations related to the lack of knowledge and low institutional capability are highly interrelated. Brown & Farrelly (2009) describes that these barriers are interwoven and interdependent. As an example, the inability to generate information (pre and post projects) compromises the decisions about implementing integrated approaches. Additionally, a fragmented regulatory framework produces inconsistencies at multiple dimensions and levels, within roles and responsibilities, and unevenly affecting the institutional capability. Whereas, policy and legislative developments tend to comprise fragmented and contested information, reinforcing the impediments. Thereby, Brown & Farrelly (2009) suggest systematically addressing these barriers and targeting simultaneously diverse restrictions embedded in cultures, structures and relationships of the water systems.

A systematic approach to deal with complexly interlinked limitations involves a governance approach. Governance has been used to define the manner of maintaining political order while providing public services (Bulkeley, Broto, & Edwards, 2015). Recently, the definition has grown in scope to recognise the administrative systems that are involved in water resources management, including rules, practices and processes (together with the informal ones) through which choices in water management are decided and implemented while incorporating the concerns of the community (the definition was complemented by the OECD in 2015, Koop & Van-Leeuwen, 2017: 395). Thereby, it has been recognised as a social phenomenon that involves ideology, institutions, structures and governmental instruments (procedures, regulators, and policy instruments, among others) and being wider than the state because it involves

actors and networks interactions and power struggles (Smith *et al.*, 2005). Hence, this term has also been used to define the processes that are necessary to ease long and sustained changes (transitions) while producing a suitable context for changes (Smith *et al.*, 2005), as IUWM approaches require. Additionally, water governance has been evolving within the water system, responding to the pressures that have shaped the water infrastructure (Van de Meene *et al.*, 2011; Villada-Canela *et al.*, 2019). Currently, conventional water governance that supports centralised and piped WSS has been pressed by existing pressures on water resources and the existing institutional incapability (Neto, 2016). Meanwhile, there is more recognition of the role of community participation in changing the manner that water is consumed and managed. Stakeholders, from providers and to end-users of the services, have been included in the water management decision making, pushing the water governance into a network structure (Neto, 2016; Pearson *et al.*, 2010; Van de Meene *et al.*, 2011).

There have been some recommendations on how to guide the water governance to include sustainable principles, through integrating strong policies, plans, programmes, and instruments to define its progress (Bahri, 2012); while aligning land use policy, climate change and energy regulations with water management goals (Ferrier *et al.*, 2009). However, the governance adaptation into a network structure has also been limited by institutional fragmentation, poor intergovernmental relations, lack of political leadership, limited long-term strategic planning and deficiencies in public participation (Castro, 2007; Van de Meene *et al.*, 2011). These limitations have also been found in Singapore, where despite having political leadership and institutional capability, this country has implemented a top-down approach that relegated community participation in decision making (Jensen & Nair, 2019), highlighting the complexity in changing the water governance structure.

Hence, some authors described the importance of experiments in developing knowledge that can permeate into governance structures (Bos *et al.*, 2013; Evans, Karvonen & Raven, 2016; Karvonen, 2011). Farrelly & Brown (2011) suggest that empirical projects make people aware of the existence of alternatives and innovations in water management. Hence, some international agencies, such as the European Union Global Water Partnership (GWP), the International Water Association (IWA) through its Cities of the Future Programme, Local Governments for Sustainability organisation (ICLEI) and Australia´s Commonwealth Scientific and Industrial Research Organisation (CSIRO), have been sponsoring some programmes and pilots about alternative approaches in water management or IUWM approaches (Schuring, Rodriguez & Closas, 2012). However, most of these pilots remain in proposals and studies, lacking real evidence in empirical cases. Additionally, Furlong *et al.* (2017) recognise the limited information about empirical cases in water management transitions, especially as failure cases are not reported at all. This can only be mitigated through developing more research in the area.

As a summary, alternative approaches in water management can be induced through experiments that generate institutional capability and knowledge about new technology and practices. Eventually, this knowledge and institutional capability contribute to creating a protocol that influences further water

governance. New governance can promote more experiments and then more knowledge. This water governance adaptation cycle is represented in Figure 2.3.

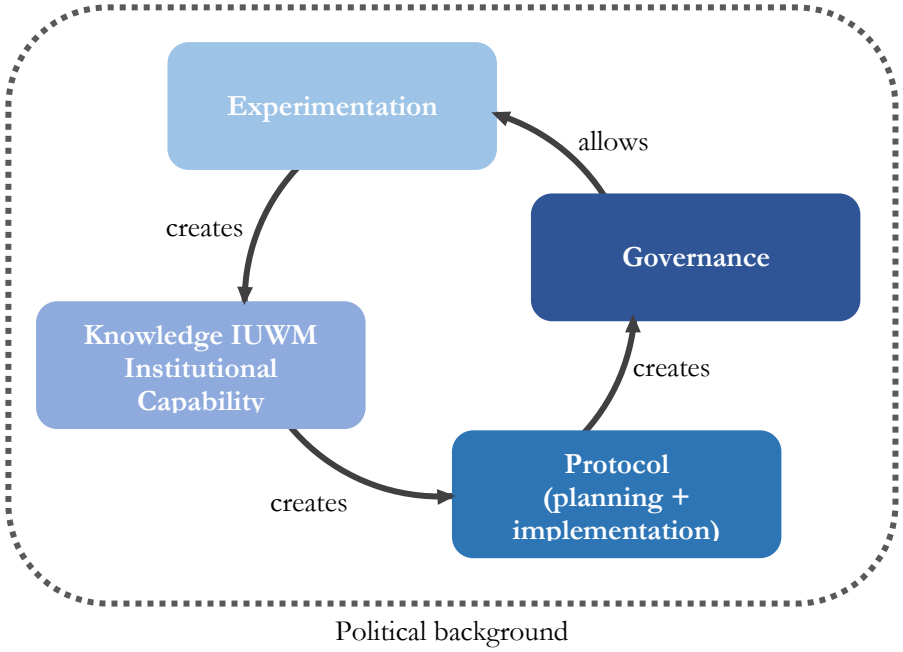

Figure 2.3 Water governance adaptation through experimentation

This governance restructuration through experiments, also known as adaptive governance, is continually improved by testing and learning from the outcomes of projects and policies. An approach that requires the monitoring and measurement of change, recognising mistakes and adopting adjustments (Feldman, 2007a; Moglia & Sharma, 2010). This may work in settings where water systems and their institutional capability are relatively efficient. However, all water systems are embedded in political backgrounds[1], as Figure 2.3 shows, a theme that is poorly contemplated in the literature related to IUWM. Furlong *et al.*, (2016b) already described IUWM as a *"Nirvana Concept"* because it commonly obscures the political background of water management. Similarly, water governance tends to be classified as apolitical under an administrative-technical approach that denies debates, negotiations and confrontations that emerge concerning social values and needs (Castro, 2007; Maiello *et al.*, 2013). This lack of consideration of the political issues is odd, especially as there is considerable literature on empirical projects that involved a change in water management, such as river restoration, which faced problems related to power struggles and political matters during the implementation phase.

[1]A topic supported by Scoones (2016), who argues that natural resources (as water) are embedded in political contexts because these are constructed through social and political processes, likewise resource scarcity.

2.3 Political background

Before deepening in this topic, it is necessary to distinguish the differences between the terms *"political"* and *"policy"*. This research considers Mouffe (2005)definition of political as the antagonism or conflict that is endemic of human societies, while the policy[2] is defined as the set of regulations, practices and institutions that control conflicts and create order. The term *political* can generate certain confusion, especially as authors such as Meadowcroft (2011) uses it to refer the involvement of government (especially as government participation is necessary to ensure sustainable trajectories) while defining that any sustainable project is inherently political due to political parties and major economic groups involvement in these matters. This section uses the term political as defined by Mouffe (2005) but recognises Meadowcroft´s (2011) terminology due to the antagonistic character of water that tends to commonly involve the government as an intermediary to manage related affairs.

The political character of urban water is highly recognised, especially in the academic literature *"since it addresses the relationship between unequal access to water services and inequitable urban governance"* (Jaglin & Zérah, 2010: vi). The political nature of water commonly translates into the water management, which tends to become vulnerable to specific interests and competing actors defending their *status*, power and goals (Brandeler, Gupta, & Hordijk, 2018; Cousins, 2017). A political context can be positive, as in the case of Singapore, where the government achieved a comprehensive vision towards an IUWM through looking for water independence and a stop to relying on water imports from neighbouring Malaysia, who threatened to cut off the water supply to the island (Chen *et al.*, 2011). This country accomplished water governance independence, aligning various policies and agencies towards guaranteeing water in the long term (Bahri, 2012; Chen *et al.*, 2011; Jensen & Nair, 2019). However, this case is an exception as political disagreements tend to increase when changes in water management system are introduced, especially when sustainable principles are incorporated in this domain.

Taking the notion of Nadaï & Labussière (2017) on how the politicisation process occurs and specific issues become relevant or a matter of concern to the society, it can be stated that sustainable matters emerge as political issues. This happens when the public recognises that ongoing practices fall short in responding to particular problems and request solutions. Moreover, Khoo (2013) defines that sustainability eventually raises conflicts due to the competition between different visions about objectives and mechanisms to achieve sustainability (Cousins, 2017; Hansen & Coenen, 2015; Morison & Brown, 2011). These conflicts and disagreements include different perceptions and definitions in regards to water governance and policy, such as decisions that relate to technology, costs, land use and other forms of competition-related with traditional practices (Cousins, 2017; Ioris, 2017; White, 2017). Hence, alternative approaches in water management are not neutral elements. Sometimes they have been used to defend particular institutional frameworks, which continue to respond to political, social and economic struggles rather than environmental interest (Mostert, 2009; Stead, 2014); or they can be

[2] Mouffe (2005) uses the term politics, but to maintain certain coherence this research change the term politics for policy.

perceived as a threat to the institutional existence and related actors (Foxon & Pearson, 2008; Hess, 2020). Hence, to illustrate these struggles, some small projects that can be considered as IUWM sub-projects (Furlong *et al.*, 2017) are described.

River restoration projects

Watercourses and surrounding ecosystems recovery can be considered the first step in introducing alternative approaches (Neto, 2016). For Novotny (2013), it is necessary to identify and bring to the surface buried streams, canals and wetlands before any retrofitting urban project, as these restored water bodies should become the base point for designing the city. Additionally, restoration projects involve integrated plans, physical renewal schemes and policy (Sairinen & Kumpulainen, 2006). They can be considered a successful practice due to the significant number of rivers that have been intervened in urban areas (Bunce & Desfor, 2007; Deak & Bucht, 2011; Kibel, 2007; Sairinen & Kumpulainen, 2006).

Rivers, wetlands and their related ecosystems have been the environments most affected by human influence (Austin, 2014; Raja Segaran, Lewis & Ostendorf, 2014). Therefore, restoration schemes are often difficult and involve long periods and large investments (Palmer *et al.*, 2005; Sandusky-Aber *et al.*, 2012). Additionally, water bodies' management is highly complex, especially if considering that they are part of a broader aquatic system because they are connected to other water bodies and wetlands (King & Brown, 2011). This complexity evolved from inadequate overuse as a result of land-use conflicts, insufficient information, market failures and intervention catastrophes (Turner, 1992), while the current management tends to be fragmented and carried out by different institutes with overlapping jurisdictions and responsibilities (Poff *et al.*, 1997). Rivers are often managed with limited institutional capacity, and this is complicated by the high number of agencies that intervene in water bodies, as the case of the River Thames in London, which is managed by a considerable number of agencies that are not coordinated with each other. Here, transport agencies have a specific power in the river but have no relation to the conservation or water services, and this complicates the river´s administration and management. This low coordination increases as there is no integration between water and land use planning, leaving water without a policy that protects and enhances the water space (London River Association, 2000: 9). Therefore, it is common to see rehabilitation projects failing due to incongruences between different institutional frameworks, as regulations enable sustainable practices but constrain them into bureaucracy procedures driven by temporary actions, scheduled times and technical constraints, or even replace them by simple solutions that are more aligned to short-term common governance agendas (Maiello *et al.*, 2013; Ostrom, 2009; Sanabria & Hurtado, 2017).

Also, restoration practices are commonly accompanied by insufficient scientific information and inefficient analytical methods. Darby & Sear (2008) describe that most of the restoration goals and objectives tend to be unclear, incomplete or fail to provide principles to make them operational, limiting restoration functionality. Additionally, these projects comprise uncertainty and complexity, so returning some landscape characteristics to pristine conditions maybe not ecologically possible (Wiens *et al.*, 2012).

However, most of the limitations of these projects are related to the institutional and social domain. There is little institutional confidence in developing such practices (Darby & Sear, 2008) or they may not be socially desirable due to the opposite interest of water users and landowners, especially in present times, when climate change may increase the impact on natural resources or land use (Petry & Dombrowsky, 2015; Wiens *et al.*, 2012).

Objectives behind water restoration or naturalisation projects are many, such as environmental benefits (water infiltration, water storage, reducing urban island heat effect, improving biodiversity and wildlife) and social well-being (Grant, 2016; Sairinen & Kumpulainen, 2006). However, most of the goals of restoration projects are related to utilitarian benefits, such as transforming neglect areas into bourgeoning neighbourhoods (Kibel, 2007; Wild *et al.*, 2011), which are often opposed to environmental restoration goals (Darby & Sear, 2008). Hence, the necessary governmental support to restore water bodies can easily influence the projects, turning their objectives into political and economic goals. This is the case of Santa Lucia Riverwalk in Monterrey Mexico, which can be considered the most famous intervention of a river in this country. This project has been criticised by Prieto-Gonzalez (2013) who claims that this artificial channel built over the original river, a justification to create a political image and to fulfil political interest, overlooking not only environmental concerns but social needs. Similarly, Morandi *et al.* (2014) highlight the political influence in the French river restoration programme, where the monitory benefits and evaluation of restoration projects tend to be used to legitimise political decisions rather than having a scientific base.

The study of different river restoration projects presents that the most common problem is the disagreements between different stakeholders´ perceptions of these projects. Eventually, disagreements turn into conflicts charged with political interests. The most representative example is the restoration of the Cheonggyecheon stream in South Korea. Cho (2010) describes that this project development was highly characterised by the confrontations between the authorities who took a technological approach and some community members who wanted an environmental and historical restoration. This confrontation was mediated through a political process, prioritising bureaucratic procedures and private interests, while dismissing community participation. Cho (2010) criticises this project when it ended — the construction of an artificial stream where water is pumped to make the river flow—for political ambition. Also, the Los Angeles River can exemplify the confrontation between stakeholders. Gottlieb & Azuma (2007) describe how a community member—the poet MacAdams— spent about 15 years engaging in debates with the Army Corps of Engineers and other agencies while envisioning the idea of "*bringing the river back to life*". However, these authors describe that this visioning process was more a constant fight between the involved civil society organisation (CSO) and the agencies to force their vision of the river on the other stakeholders. Similar disagreements occurred in Helsinki, Finland, where a small stream restoration that was supported by the local community later angered the neighbours, as the brown colour of the stream caused the perception of pollution and risk. Vierikko & Niemela (2016) claim that this project failed to incorporate the socio-cultural values of the community.

Other authors claim that political disputes are common in sustainable projects because their implementation continues following traditional water management approaches that prioritise capitalist practices. This is explained by Ioris (2017), who used River Clay in Glasgow to describe how, historically, rivers have been the recipient of multiple forms of deprivation. However, current restoration projects tend to become an excuse to improve neighbours through technological approaches while prioritising specific interests and groups, but without dealing with the real problems, such as dispersing pollution and social inequalities (Ioris, 2017). Some researchers claim that sustainability tends to be used to legalise profitable projects at expenses of vulnerable people. Ellis (2011) claims that environmentally friendly concepts and community participation programmes (from middle and high-class residents) were used to depoliticise a project and make it look uncontested, despite evicting informal settlements that were not included in the discussion, such as what happened near Adyar Poonga River in Chennai. This is a practice commonly used to validate projects and perpetuate power structures (Maiello *et al.*, 2013). Something similar occurred in Tijuana, north of Mexico, where a project to prevent pollution reaching the United States was used to remove vulnerable people and informal settlements and to create commercial and business area for the city. Despite causing anger within the removed population, the project was executed, resulting in a ten-mile concrete channel (Tijuana International Flood Control Project or TFCP) that divide the city and denies any environmental value[3] (Dedina, 1995).

Restoration practices seem to remain highly technological while minimising the influence of social, political, cultural and economic values (Cho, 2010; Morandi *et al.*, 2014; Neto, 2016; Vierikko & Niemela, 2016). The political nature of water tends to be poorly considered during the planning or design of alternative practices despite the high awareness of this issue. This may be because it is challenging to map the political conflicts or power relations (Britto, 2010 referenced in Jaglin & Zérah, 2010), especially as projects may create a reaction once they are implemented or physically visualised, but not before as Nadaï & Labussière (2017) illustrated by the construction of wind farms in France. Hence, more emphasis should be placed in studying the political dimension of alternative approaches. However, this dimension tends to vary, depending on the specific location of these alternatives. Some authors (Mostert, 2009; Neto, 2016; Shuster & Garmestani, 2015; Van de Meene *et al.*, 2011) highlight the necessity of water management or governance tailored to local backgrounds, by considering the influence of governance contexts (regional, national and global factors), cultural interpretation, environmental influences and the interests of local people on implementing water management alternative approaches.

2.4 Transitions in Complex Settings

Cities are complex dynamic ecosystems where a series of resources flow between innumerable actors, zones and scales (Williams, 2019). However, cities in the global south face a series of particularities that make them even more complex. First, developing cities are highly characterised by a significant and

[3] In United States, the river´s neighbours pushed for the creation of a conservation area or Tijuana River Estuary instead of a concrete channel.

continue increment of the population due to migrations and the absence of adequate public policies. This allows the construction of a series of *slums, shantytowns, asentaminetos, favelas, barriadas, poblaciones* and *villas miserias* among other names for informal settlements around the city (Maiello *et al.*, 2013; Rodgers, Beall, & Kanbur, 2011). These informal settlements are where the poor population often choose to live, although most of them are located in physical vulnerable and socially marginalized environments (Abbott, 2002; Reed, 2013). Second, rapid urban sprawl races ahead of any formal planning (Arrojo, 2006; Horlemann & Dombrowsky, 2012; Rolnik, 2013), while authorities are facing struggles in supplying basic services to these settlements, because it requires high investments that they do not have (Ferguson & Navarrete, 2003; Marvin & Laurie, 1999). All of these factors are accompanied by weak and inefficient governmental structure, the fragmented and uncoordinated performance of agencies, political and economic instability, lacking transparency and accountability in the decision-making processes, low of capacity building or knowledge sharing, the limited capability to enforce legal frameworks, and uncertainty about population forecasts that limits the already deprived planning capability (Drinkwaard, Kirkels & Romijn, 2010; Hansen *et al.*, 2017; Ramos-Mejía *et al.*, 2018; Schuring *et al.*, 2012; Tortajada, 2010). Despite the intricate context that challenges transition, it is also important to recognise that sustainability is not an urgency in these countries, which deprioritise it behind many rigid and short-term development objectives aiming to reduce poverty (Hamann & April, 2013; Wieczorek, 2017).

Studies about sustainable transitions are growing in the developing world, especially in the area of energy transitions in Africa and Asia (Mah *et al.,* 2017; Osunmuyiwa, Biermann & Kalfagianni, 2018; Rock *et al.*, 2009; Wieczorek, 2017), while there is a research gap in the area of transitions in water management in Latin America. These studies on energy transitions have recognised the limitations of translating Transition Theory from one geographic location to another, highlighting that some caution is needed, as transitions may occur through different patterns in the developing world compared to the European context (Berkhout, Angel & Wieczorek, 2009; Berkhout *et al.*, 2010; Furlong, 2014; Hansen *et al.*, 2017). Hence, some criticisms have emerged concerning sustainability in the developing world, where projects, policies and initiatives tend to be imported from the developed world without truly understanding the context or creating a support system (i.e. behaviour, rules, and markets, among others) (Acheampong, Swilling & Urama, 2016; Fuenfschilling & Binz, 2018). As an example, Tong & Yan (2013) describe how countries tend to focus on inducing sustainability through financial rewards (funds, subsides or fees) that inhibit local initiatives for conservation, innovation designs and entrepreneurship proposals.

Also, evidence collected by Hansen *et al.* (2017) suggests that the weak role of experimental projects in the developing world rarely result in significant changes in inducing sustainable transitions. This is because they tend to be implemented in isolation without delivering expectations alignment, a learning process or the formation of new networks (or commonly known in the theory as a niche: emerging technologies and supporters, see Chapter 4). This shows that the necessity in understanding the role of established systems in restricting or allowing transitions in the developing world. However, other debates

emerge concerning to the viability of inducing transition due to the characteristics of these systems (established technologies and incumbent actors that comprises systems, which are also called regimes) as such systems are dysfunctional and non-uniform. At the same time, their dynamic conditions create uncertainty and barriers to change (Wieczorek, 2017).

Socio-technical systems in the developing world comprise several formal and informal arrangements with blurry boundaries and hybrid infrastructure (Furlong, 2014; Gazull, Gautier & Montagne, 2019; Jaglin & Zérah, 2010; van Welie *et al.*, 2018). Hansen *et al.* (2017) describe that in most cases there is a single formal system that is weak and unstable, while there are also few informal systems that are highly interlaced with social arrangements (Ramos-Mejía *et al.*, 2018). Mostly the governments´ focus is on developing a centralised-pipe system which can be categorised as the formal and dominant system (or regime), but the incapability of providing services to larger segments of the population open windows to different (informal) arrangements that complement the centralised-pipe system in delivering services (van Welie *et al.*, 2018). These systems recognise the intervention of different levels of government in investing and expanding formal and informal arrangements simultaneously (Jaglin & Zérah, 2010). This was corroborated by Angueletou-Marteau (2010, referenced in Furlong, 2014) who describes that sometimes the actors involved belong to both structures, formal and informal (i.e. local councils are also private water vendors in India). They support one or another system according to their interest while inhibiting changes in both. In theory, transitions require the destabilisation of the current dominant system to change it, which require previous stability of the system that barely occur in developing countries (Geels, 2002; Hansen *et al.*, 2017; Loorbach, Frantzeskaki & Avelino, 2017; Turnheim & Geels, 2012). Gazull *et al.* (2019: 1087) describe that the informal regime is *"flexible and capable of adapting to any attempt at destabilization"*. This can be achieved rapidly through adapting networks, practices and even products, and because of the significant economic revenues related to the informal activities (Tong & Yan, 2013).

Hence, *Incumbent-led Transition* is a research field that is growing as the role of incumbents or the regime´s actors in transitions has been recognised. These stakeholders have the capacity of shaping socio-technical systems configurations and introduce sustainable innovations (Hess, 2020; Mah *et al.*, 2017; Stenzel & Frenzel, 2008). Augenstein & Palzkill (2015) recognise that incumbents will rarely push for a radical transformation as it can threaten their existence and interests, but they can create spin-offs that can evolve into a bigger change in the regime. Hess (2020) describes incumbent-led transitions as the systemic technological change lead by industrial corporations. However, governments start to take an active role to enable transitions as incumbents, as the case of automatisation of vehicles in the UK. Hopkins & Schwanen (2018) describe that in this particular case, the government became the leading promoter of experiments while enabling the landscape and setting policies to promote a change in the transport system. Also, cases appeared in the developing world, especially in Asia (Berkhout *et al.*, 2010). In Thailand, there is the case of the government involving incumbents of the transport system to promote experiments to modernise the motorbike taxi mobility regime (Sengers & Raven, 2014).

Incumbent actors tend to have mixed reactions towards innovations, as they may change their attitude towards them, sometimes restricting and supporting simultaneously. This is because innovations are perceived as competition or as opportunities to increase economic revenues (Hess, 2020; Mah *et al.*, 2017; Smink *et al.*, 2015; Stenzel & Frenzel, 2008). *Incumbent-led Transitions* provides opportunities for sustainable adaptations, but these type of transitions have been barely studied. Most of the studied cases focus on industrial organisations fostering economic benefits for companies and market creations for the innovations (Hopkins & Schwanen, 2018; Stenzel & Frenzel, 2008), while minimising to understand other variables that influence this type of transition, such as the political background.

The political character of the regimes is important, especially in the developing world where systems are highly intertwined with political interests. Despite that this claim can be inserted too in the developed regimes and some authors have raised the political component in transitions (Avelino et al., 2016; Scoones, 2016), in developing countries political dynamics are characterised by *clientelism* and *patronage* relations. Whereas, ill-functioning institutions replicate existing power relations and exclusion patterns (Ramos-Mejía *et al.*, 2018), complicating changes. Osunmuyiwa *et al.* (2018) describe that powerful groups use patronage network between corporations, governments and political parties to block transitions while simultaneously reinforcing *informal power structures*. These networks involve financial contributions that influence the emergence of political office holders, whom to retain their *status quo,* make decisions that maintain the regime and relegate any attempts for transition (Osunmuyiwa *et al.*, 2018). Although this negative political interference, it is recognised that governments' intervention in transitions plays a fundamental part in achieving a change in developing countries, such as in reducing pollution and waste in the case of East-Asia (Jolly & Raven, 2015; Rock et al., 2009) and achieving partially energy transition in Nigeria (Osunmuyiwa & Kalfagianni, 2017).

The impact of this dual political influence in the regime and incumbents have received limited consideration in transition studies. Therefore, there is a need for cause-effect research that focuses on change across time and explores how incumbents respond to innovations and external pressures, especially in changing or maintaining the regime and innovations in developing countries. Smink *et al.* (2015) recommend having more understanding of the activities incumbents perform to influence innovations or study the power they execute to allow or restrict them, especially as incumbent-led transitions can create broader reactions (positive or negative) in the social system. Hess (2020) recognises that these transitions can also generate public concern and mobilisations, deaccelerating sociotechnical transitions. Hence, this research needs to include local characteristics and the behavioural differences of the regimes in diverse locations (Hamann & April, 2013; Raven *et al.*, 2012), as the political background.

2.5 Summary

Most of the empirical cases of transitions or experiments that relate to this thesis can be divided into two main groups. First, water management transitions in the literature are dominated by IUWM, or IRWM approaches investigated and tested in the developed world. Here, the lack of institutional capacity

and knowledge about practices tend to be the most significant limitations. Second, there is considerable documentation about cases of transitions in the developing world, especially studying energy transition, revealing that complex contexts and the intricate regimes highly influence transitions in these countries. However, there is a considerable research gap in transition research that focuses on IUWM approaches or water management approaches in developing countries, especially concerning sustainable transitions promoted by incumbents. This is because it is assumed that regimes and incumbents only block transitions in the developing world. However, these actors have also been influenced by external pressures that have pushed them to change the regime to allow or restrict changes (or distribute power, see Chapter 4). This research gap should be addressed, considering the political context that is inherent to water management and developing countries, as well as the local characteristics of this type of transition.

Chapter three

3 Study Methodology

This chapter describes the series of procedures and considerations taken to discover the main limitations and opportunities in introducing a sustainable change in water management in Mexico City. This thesis studies the sustainable trajectory of water management by reviewing in-depth two case studies that aimed to introduce a change in the water system. Section 3.1 introduces the focus of the study. Section 3.2 covers the research design that explains the theoretical perspective and the rationale of choosing qualitative research based on case-studies. Section 3.3 describes the data collection methods and data analysis. The taken ethical considerations are described in Section 3.4, while Section 3.5 defines the limitations of this study. Section 3.6 lists the strategies employed to increase the research quality. The chapter concludes with a summary in section 3.7.

3.1 The focus of the study

This research focuses on the water management system in Mexico City and recognises that transition in water management is difficult to achieve when this city has been historically embedded in a fight against surface water (Legorreta, 2006). There has been barely any change in the manner by which natural resources are managed and water services delivered in the city, despite several attempts to incorporate a change in water management (Burns, 2009; Burns & Lopez-Reyes, 2011) and the commitment of the country to improve water management and to include sustainable principles (CONAGUA, 2011; Gobierno de la República, 2013; Ley de Aguas Nacionales, 2016).

Centralised and piped water supply and sanitation services tend to be inefficient due to inappropriate use and management of natural resources, but this is an institutional-political problem rather than a technological one (Brown & Farrelly, 2009; Dinar & Saleth, 2004). The literature suggests that water governance can be adapted to facilitate the implementation of alternatives (IUWM), and this governance has to be tailored to local contexts. However, little research has done about how power (political power) influences incumbent-led sustainable transitions in water management, especially in a complex context characterised by a heterogeneous system or regime. Motivated by this gap in knowledge, the thesis aims to study the dynamics that exist between the regime and incumbent-led sustainable projects to understand better heterogeneous and complex regimes, especially in developing countries like Mexico. This thesis aims to address the following **research question** (outlined in section 1.4):

> *How do urban water systems and related actors respond to transition pressures towards sustainable and integrated approaches, especially in developing countries?*

The following sub-questions support this question:

1. What is the role of regime-led experiments in responding to transition pressures?
2. What are the main challenges that regime´s actors or incumbents face in changing the regime´s practices and introducing IUWM approaches?
3. Do incumbent or regime-led sustainable initiatives contribute towards creating a transition trajectory and the creation of niche- innovations?

3.2 Research Design: multiple case study design

Creswell (2014) defines research as a process that requires a series of actions, plans or procedures, which eventually dictates the process of acquiring data, data analysis and interpretation. Following this idea, Gray (2004) describes a research process as a series of six elements: (1) a fundamental level of how the researcher understands the process of manufacturing the knowledge or epistemology, (2) the theoretical perspective that defines (3) the research approach, (4) the methodology and (5) time frame, which eventually delimitates the data collection methods (6). This research is conducted under the

constructivism perspective, with Transition Theory as a theoretical perspective, a mixture of deductive and inductive research approaches, case-study design and a cross-sectional time frame (Figure 3.1).

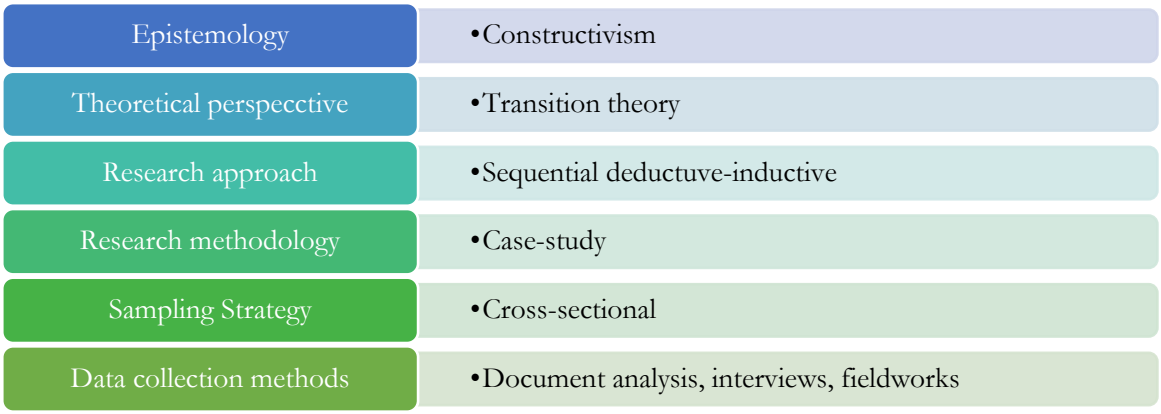

Figure 3.1 The elements of the research process in the thesis

Commitment to constructivism

Gray (2004) and Henn, Weinstein & Foard (2006) explain that the societal based research can be influenced by three **epistemological** positions, which study the social world through certain assumptions, and these epistemological positions are: objectivism, constructivism and subjectivism (Gray, 2004). Objectivism, explains social phenomena as a series of external factors away from the influence of the researcher, while subjectivism implies that the meaning is imposed by the researcher (Bryman, 2012; Gray, 2004). Constructivism claims that truth and meanings are created through interactions between the researcher and the world (Gray, 2004). This research recognises the constructivism perspective due to the researcher involved in constructing ideas and concepts during the data collection and analysis process, something that commonly occurs in research based on qualitative data (Saldaña, 2013 referenced in Miles, Huberman & Saldaña, 2014). The literature suggests that under the constructivism perspective, facts and ideas emerge from previous frameworks, providing particular order to the reality, and aid to reproduce such reality within some impartiality. Thereby, it is impossible to separate the constructed structure (ideas and knowledge) from the studied reality, the available theory, methodologies and methods provided by a scientific background (Retamozo, 2012).

In line with the constructivist thinking, this thesis recognises that the studied problem is also a study of the interaction between an object (and event) and the observer. The observer appreciates (observes and values) the object through intentional meanings (Davis, 2019). That means the observer sees the object through lenses of consciousness, language, cognitive and no cognitive sensibilities, and personal, social, and cultural preconceptions (Clark, 2014; Van-Manen & Adams, 2010). After this appreciation, an object itself become a phenomenon, so it is impossible to separate people perception to understanding such a phenomenon.

Theoretical perspective and research approach

The thesis aims to unravel the variables behind the success and failure of sustainable water management projects. However, facts are only significant when they are placed in an explanatory context or theoretical perspective (Eckhardt & Ermann, 1977). A theory is defined as a logical explanation of the world (Eckhardt & Ermann, 1977). However, for a researcher like Kerlinger (1986, referenced in Gray, 2004) theory is more complex, as it is an interacting framework of concepts, definitions and propositions that explain systematically certain phenomena while specifying relations among variables. The theory provides the philosophical perspective that influences the choice of methods and methodology for the research (Fahy & Rau, 2013). The research approach dictates the position of the theory in the research. The deductive approach takes the theory as the starting point while using the data to test, prove or disqualifies the theory. The inductive approach implies that theory emerges from the data and the iterative analysis of it (Daly, 2007).

Transition Theory has been chosen for this research because it has been widely used to investigate the reasons for the adoption of a specific technology (Grin, Rotmans & Schot, 2010), especially the acceptance of sustainable practices (Crespi, Mazzanti & Managi, 2016; McLellan, Chapman & Aoki, 2016; Zeppini, 2015), like Integrated Urban Water Management approaches (de Haan *et al.*, 2015). Therefore, it can provide an adequate lens to understand the reasons behind the adoption or rejection of alternative practices in Mexico City while creating an organised framework to answer the research question.

Transition Theory, influenced by the constructivism position, allows the researcher to incorporate previous knowledge about the studied phenomena while retaining the value of the perception and explanations of people about the events. This theory provides a complex and multidisciplinary framework that allows for the incorporation of different perspectives, interpretations and values. Therefore, it creates an explicit scene to understand the series of variables that influence the incorporation of sustainable practices in the water domain.

This research combines concepts from two theoretical frameworks that emerge from Transition Theory. Here, it is important to state that the vision of combining the two frameworks arises from the Multi-Level Perspective, a heuristic framework that helps to illustrate the dynamics between the socio-technical landscape, water systems (or dominant regimes), niche innovations and innovation experiments, illustrating how external pressures to the regime can destabilise it while opening windows for transitions (Fuenfschilling & Truffer, 2014; Geels, 2002; Rotmans, Kemp & Van-Asselt, 2001). The Multi-Level Perspective (MLP) was used to illustrate the water system in Mexico City and the existing destabilisation pressures (Chapter 5). Additionally, this visualisation allows combining the Alignments and Processes of the Socio-Technical Regime model (Geels, 2011; Smith & Raven, 2012), which recognises the main structures and dimensions of the regimes, and the Transition Management Framework, which focuses on projects development (Bos & Brown, 2013; Bos *et al.*, 2013). The adapted theoretical framework aims

to recreate the dynamics between regimes and projects, especially when the regime or incumbent actors promote projects. These frameworks were chosen because they use process theory and narrative explanation, allowing the capture of complex interactions between established and alternative practices, such as the contexts, events sequences, conjunctures, long-term patterns and macro-dynamics (Geels, 2011; Grin *et al.*, 2010). The frameworks used are described in Chapter 4.

This research has a deductive approach because it took the theory as the starting point. However, after the data collection, a series of considerations emerged, illustrating that the simple use of the Transition Theory framework was not purely adequate to analyse Mexico City case. Therefore, an inductive approach was developed, incorporating data analysis and a literature review into the design of a more robust framework that allows the allocation of particularities of the water system in Mexico City. Therefore, this research is a combination of a deductive and inductive approach. The inductive-deductive research approach is illustrated in Figure 3.2.

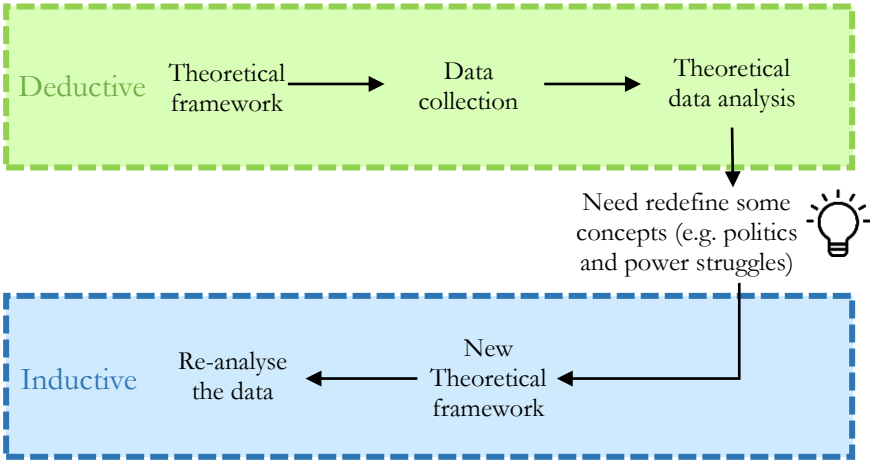

Figure 3.2 Research approach

Qualitative case study methodology

The thesis uses a **qualitative approach** based on **case studies** to understand a complex social phenomenon and to unravel variables that are not perceived at plain sight, such as the causes behind the adoption or rejection of sustainable and integrated approaches in water management. Sustainable transitions are highly social, as most of the reasons behind the adoption and rejection of sustainable practices, especially in the water management domain, range in social and institutional causes (Bos & Brown, 2013). Hence, qualitative research is valuable, as this thesis is studying a social phenomenon.

Qualitative research most significant characteristic is the use of words, so it values descriptions and explanations of human processes. Mainly, it is useful to detail events and consequences in a chronological manner (Miles *et al.*, 2014). According to Miles *et al.* (2014), qualitative research focuses on actions and

its characteristics, for example intentions, meanings, and related consequences, while taking into account social and historical context, which allows constructing an intricate image of the studied phenomenon.

This thesis recognises the broad aspects of sustainable transition and the value of using qualitative data to understand a complex phenomenon. Additionally, this research values the perception of people that witnessed the studied phenomenon and obtained direct information about causes and effects, while observing complex processes and social interactions that are not recognisable at plain sight. Therefore, it is useful to describe this problem with words, allowing to trace complexity through "*thick descriptions*" of cause-effect dynamics (Geertz,1973 referenced in Miles *et al.*, 2014). The complex dynamics can be recognised using previous projects that aimed to induce transitions in water management, especially as they illustrated the variables that emerged in a real-world, illustrating factors that are difficult to see in everyday behaviours. Hence, the value of a case study research.

The case study was chosen as the methodology because it is considered the base of transition research as it delivers an explanatory characteristic that transitions frameworks require (de Haan *et al.*, 2015). Case-studies help to visualise variables and processes that restrict or reinforce sustainable changes, providing evidence of how transitions happen in the real world (Fuenfschilling & Truffer, 2016; Hansen *et al.*, 2017; Raven *et al.*, 2012; van-Herk *et al.,* 2013; Van Der Brugge & De Graaf, 2010). Case studies have been used to identify the development of processes that are necessary in transition (Bos & Brown, 2012), to recognise co-evolutionary dynamics and institutional changes (Bos *et al.*, 2013), and to understand socio-technical transitions in the developing world (Ramos-Mejía *et al.*, 2018).

Case-studies are used to understand sustainable projects´ constraints and opportunities, while exhibiting causal processes and reducing the social world complexity, as they allow researchers to focus on single phenomenon causes and effects in a specific context (Blatter & Harverland, 2012; Neuman, 2006). The methodology allows diverse theoretical and conceptual frameworks and identifying agents (interest, identities and institutional features), cognitive process and social interactions within social structures (Blatter & Harverland, 2012). Case studies are a useful methodology to investigate a contemporary phenomenon, primarily when such a phenomenon has been highly influenced by its context, which makes it challenging to define the phenomenon itself (Gray, 2004). Gray (2004) describes this methodology as helping researchers to discover *how* and *why* the set of events affect a phenomenon, allowing the tracing of chronological events and cause-effects dynamics.

Sampling strategy

Cause-effects are important for this research, especially in considering that the data obtained should include all the variables that affected the cases and their development. The longitudinal research involved to study variations or change but needs to measure the same variables from one period to another (Menard, 2011). However, this study contemplates the collection of data once only, taking into account that the study is about the trajectory of change of Mexico City and such trajectory continue. Therefore,

the study involved selecting a period, which is recent enough to understand current behaviours and trends, but old enough to have the complete framework to understand cause-effects. Hence, the selected time frame is the beginning of the twenty-first century. This implies cross-sectional research because data was obtained just once for each case study (Menard, 2011), but the data was retrospective as it intended to gather the information that happened before. Also, as different cases occurred at different times, and they have different timing, the data collection occurs once the projects have finished and significant time has passed to study implications of the cases further. This collection of data aimed to have the perspective of the entirety of the cases and across a similar study time frame. Hence, the selected cases were those that can be considered as *"finished"*, allowing for the collection of the complete narrative of events that occurred from the beginning to the end of the case. Two in-depth cases formed the basis for the data analysis in this thesis: the Magdalena River restoration and the UNESCO-Xochimilco Project. The detailed description of the cases is given in Chapter 6 and Chapter 7.

3.3 Qualitative data collection and analysis strategies

Qualitative data collection methods

Theory, methods and data are core pieces of the research, and they need to be handled in a continued interacting process to produce coherent knowledge. Data represents information of the world or a phenomenon, while the method is the way to obtain such information in a manner that it is useful to explain the phenomenon. Data collection methods refer to specific tools and techniques used to gather or create data (Daly, 2007). Two methods were used to recreate the narrative of the two cases: document analysis and interviews. Information obtained from reports, newspapers and academic papers (secondary data) were used to describe the trajectory of the case studies. Interviews with involved actors were used to discover additional information, especially the evidence that cannot be found in the literature or reports. People´s perceptions are a crucial element to trace the causes and effects, as they witnessed certain variables that influenced events and causes. It can be stated that such data was created as participants were asked for their interpretation of events. A weakness of this research is that it relies on people making sense of the past and in storytelling. The past is constructed by the narrator, involving the selection and embellishment of events, leaving some parts out in the description (Daly, 2007). Therefore, the selection of a third method aims to minimise such weakness and provide strength and reliability to the research. Fieldwork was done to corroborate the information provided by participants. The three methods were used to triangulate and validate the information.

Document Analysis

Documents outlining the plans of both projects were provided by people involved in the design of the project, and complemented with reports found on the internet. The document analysis was useful to recognise goals, main characteristics and the design process of both projects. In the case of the

Magdalena River Restoration Project, five documents were used to understand the design and pre-development of the project. The Diagnosis and Master Plan were used to understand objectives, deficiencies and strengths of the plan, especially as information gaps were recognised in the diagnosis. Additionally, a PhD thesis help to understand the project implementation, and two other reports the final stages of the project. The documents analysed are listed in Table 3.1.

Table 3.1 Documents used to create the narrative of the Magdalena River Restoration Project.

Project	Document	Institution	Year	Description
RM	Let's Save the Magdalena River: Reference terms for the Master Plan	Advocacy Group (SEDEMA-GDF)	2008	Pre-development: objectives for the Master Plan (Reference terms for the Master Plan)
	Proposal for the Magdalena river basin Integrated Diagnostic. Master Plan for Integral Management and Sustainable Use of the Magdalena River Basin.	Multidisciplinary Group (SEDEMA and UNAM)	2008	Diagnostic
	Magdalena and Eslava Rivers Comprehensive Rescue Programme. Executive report of actions period 2007-2008.	Mexico City Environmental Ministry (SEDEMA/SMA-GDF.)	2008	Report
	Master Plan for Integral Management and Sustainable Use of the Magdalena River Basin. Master Plan of the Magdalena River.	SEDEMA(SMA-GDF) and UNAM	2008	**Master Plan**
	Urban Rivers Rescue. Conceptual and methodological proposals for the restoration and rehabilitation of rivers.	University Programme of Studies on the City UNAM-PUEC (González-Reynoso, A., Hernández-Muñoz, L., Perló-Cohen, M., & Zamora-Saenz, I)	2010	Description of the design process and experiences (aiming replication in other rivers and basins)
	Comprehensive Rescue Programme for the Magdalena and Eslava Rivers.	SEDEMA-GDF	2012	Report: End of the administrative period Mexico City Mayor (White books)
	The broken bridges of collective action. Social participation in the recovery of urban rivers: the case of the Magdalena River in Mexico City	Zamora-Sáenz (Latin American Faculty of Social Sciences FLACSO).	2013	PhD Thesis: description of the design and implementation process
	Integral Rescue of the Magdalena River	Environmental and Land Planning Attorney (PAOT)	2014	Report about the condition of the Magdalena river and the marginal drainage (part of the Restoration project)

The Project UNESCO-Xochimilco is supported by official documents that give understanding to the management plan and its design process. This project´s main goal was the design of a Management Plan, so when this plan design was finished, the project terminated, so there is not enough information about the implementation process. Therefore, an academic paper was used to recount the project ending. Additionally, two books that reported a parallel project supported by UNESCO, the *chinampas* cataloguing process, were used as they describe the current condition of the site and the subsequent

involvement of UNESCO in the site after the management plan was included. The documents are listed in Table 3.2.

Table 3.2 Documents used to create the narrative of Project UNESCO-Xochimilco.

Project	Document	Institution	Year	Description
PUX	Reactive Monitoring Mission to World Heritage Site Historic Centre of Mexico City and Xochimilco	UNESCO (Arizaga-Guzman, D.)	2002	Pre-evaluation of the site
	Water. Final Document SIRCHAL Workshop.	Team UNESCO (Alonso-Navarrete, A.)	2004	Project design: report SIRCHAL workshop
	Xochimilco: A process of participatory management	Team UNESCO (Caraballo, C.)	2006	Design: process description. Also, known as the orange book
	Project UNESCO-Xochimilco. Mexico City.	UNESCO-Mexico	2006	Phase I and II. Results of the study and participatory workshops to design the Management Plan
	Executive report (Phase III).	UNESCO-Mexico	2006	Report of activities Phase III
	Phase III Report	UNESCO-Mexico	2006	Results Phase III
	Summary of the Integral Plan and Management Structure of Xochimilco, Tláhuac and Milpa Alta area inscribed in the list of UNESCO World Heritage	UNESCO-Mexico	2006	**Management Plan:** proposed actions and budget
	Management indicators in complex systems. The Project UNESCO-Xochimilco as a management laboratory	Team UNESCO (Caraballo, C.)	2007	Paper: description of the indicator system of the PUX Management Plan
	Project UNESCO-Xochimilco (PUX)	Zabaleta-Solís, D.	2010	Paper: reflection about the PUX ends
	The Chinampas of Xochimilco at the dawn of the 21st century: the beginning of its classification.	UAM-Xochimilco. Chinampa Catalogue Project (Gonzalez-Pozo, A., Diaz-Berrio, S., Chiapa-Sanchez, F., Arriaga-Tellez, C. E., & Castro-Garza, J. G.)	2010	UNESCO requested the Chinampas catalogue Project. This was a parallel project to PUX, which recalls about UNESCO´s participation in the site after the PUX conclusion.
	The Chinampas: World Heritage of Mexico City.	UAM-Xochimico. Chinampa Catalogue Project (Gonzalez-Pozo, A., Chiapa-Sanchez, F., Castro-Garza, J. G., Angeles-Escamilla, B., Montano-Pedraza, M., & Toledo-Esteban, M.)	2016	

Also, newspapers were obtained visiting the National Newspaper Library (Hemeroteca Nacional), located in the National University (UNAM) campus. Despite having these documents, there are some voids concerning project development, especially the end stages of the projects. Hence, it was necessary to interview the people involved in the development of these projects.

Interviews and Participants

After a reconnaissance field trip in August-September 2015, four main actors in water management were identified and asked about the main constraints of water sustainability in Mexico City (see Table 3.3). Most of them recognised the lack of support to make any water-urban project a practical reality,

remaining just like proposals. The information provided by these four participants was used in the theoretical framework adaptation for the Mexican context (Chapter 5).

During this process, the Magdalena River Restoration Project emerged as one of the few projects that have been implemented. A Magdalena River Project coordinator was identified (RM07), and he described the project development and his experience in an interview that was subsequently used as a base to design the interview questions.

Table 3.3 Problem recognition interviews

Interview	Experience
A	National University (UNAM) Professor. He was also involved in the Magdalena River project's design phase.
B	Architecture professor from the National University (UNAM) and a member of Taller Hídrico-Urbano, a workshop for architect students to create solutions for existing hydrological problems in Mexico City.
C	Metropolitan University (UAM Iztapalapa) Professor. He was part of the academic team that wrote two water management plans for the Mexico City Valley.
D	Private consultant. He advises industries about water affairs within the government. He used to work for Agriculture and Hydraulic Resources Ministry (SARH) on the 80s; later he joined CONAGUA once the Agriculture Minister was dissolved to create different agencies.

The subsequent interviews were conducted from September 2016 to January 2017. The first participants were identified in the documents as authors and contacted through their academic information (email invitation in Annexe A, p. 274). Other participants were contacted during the *7th Chinampas Conservation and Cultural Landscapes of the Mexico City Seminar-Workshop* in UAM-Xochimilco held on November 2016. Consequently, participants were identified through a *snowball* process, which is a recruitment technique where existing participants are encouraged to refer other participants to be interviewed (Perez *et al.*, 2013).

Interviews were face to face, semi-structured and recorded. The questions aimed to recognise the development (or history) of the projects while gathering the opinions of the participants about the factors that were positive or negative about the project (see the complete Interview Guide in Annexe B, p. 275). The questions were set to guide the participants to narrate the projects´ events comprehensively: the story of the project development, their participation in it and their opinion about the project. Interviews were conducted in Spanish, the native language of the researcher and most of the participants. Participants received a brief explanation of this research (Information Sheet, see Annexe C, p. 277), agreed to be recorded and gave permission to provide information to be used for academic purposes (Consent Form, see Annexe D, p. 279). Interviews were intended to last about an hour, but the time varied depending on how the interviewees were engaged in the project. Hence, interviews with designers or coordinators of the project tended to last over the hour (about 20 minutes more), while people involved in concise moments tend to talk less than an hour. Interviews were transcribed and analysed

using NVIVO11, a qualitative data management software (http://www.qsrinternational.com/nvivo/what-is-nvivo). Annexe E (p. 281) shows an exemplary excerpt from an interview transcript.

The Magdalena River restoration case was reconstructed with 20 interviews of people involved in this project. Table 3.4 enlists the interviewees and their relationship to the project. Interviewees RM01 to RM06 comprise academics from the National University (UNAM) who were in charge of the project's Master Plan design. Interviewees RM07 and RM08 were members of the project´s coordination team, under Mexico City's Environmental Agency (SEDEMA). Interviewee RM09 was a local government representative (Magdalena Contreras Municipality) who witnessed the closure of this project. Interviewees RM10-RM17 were Magdalena River's neighbours and Interviewees RM18 and RM19 neighbours from the Eslava River. Interview A was also used in this case, as the interviewee mentioned several times that the Magdalena River exemplified the sustainable transition in the city.

Table 3.4 Interviews from the Magdalena River project's stakeholders

Project	Area		Interviewees
Magdalena River Restoration Master Plan	Academy	A	Project Coordinator-Design phase
		RM01	Project Coordinator-Design phase
		RM02	Biologist. UNAM River Ecosystem Laboratory
		RM03	Masters student doing a thesis about the river
		RM04	Biologist. UNAM Mountain Laboratory
		RM05	Biologist. UNAM Mountain Laboratory. Involved in community workshops
		RM06	Biologist. UNAM River Ecosystem Laboratory
	Government	RM07	Coordination team-implementation phase (interviewed in the reconnaissance field trip)
		RM08	Coordination team- implementation phase
		RM09	Magdalena Contreras Municipality 2012-2014
	Community	RM10	Lower river basin neighbour (Chimalistac)
		RM11	Magdalena Atlitic neighbour
		RM12	San Nicolas Totolapan neighbour
		RM13	Magdalena Atlitic communal landowner
		RM14	River neighbour and Academic
		RM15	Magdalena Atlitic communal landowner
		RM16	Dinamos Park´s merchant
		RM 17	Magdalena Atlitic, son of a communal landowner
		RM18	San Nicolas Totolapan landowner
		RM19	San Nicolas Totolapan landowner

The UNESCO-Xochimilco Project was re-constructed with 17 interviews. Six participants were members of the UNESCO team (PUX01-PUX06), four members of the community (PUX07-PUX10), three academics (PUX11-PUX13), three members of the government (PUX14-PUX16), and PUX17 a member of the International Council on Monuments and Sites (ICOMOS). ICOMOS is in charge of reporting to UNESCO about the heritage site condition. Table 3.5 shows the list of the interviewees that participated in this case.

Table 3.5 UNESCO-Xochimilco Project Participants Interviewed

Project	Area		Interviewees
Xochimilco's Management Plan	UNESCO's project team	PUX01	Project Coordination
		PUX02	Territory Planning
		PUX03	Public participation expert
		PUX04	Data collection
		PUX05	Planning and development projects
		PUX06	Cultural heritage
	Community	PUX07	A farmer from Santiago Tepalcatlalpan
		PUX08	San Gregorio Atlapulco neighbour
		PUX09	San Luis Tlaxialtemalco neighbour
		PUX10	Xochimilco neighbour
	Academy	PUX11	Hydrologist UNAM
		PUX12	Planner UAM
		PUX13	Biologist UNAM
	Government	PUX14	Tourism office
		PUX15	Xochimilco Municipality 2016-2018
		PUX16	Environment Office and San Luis Tlaxialtemalco neighbour
	NGO´s and other agencies	PUX17	ICOMOS Mexico City

Interviews were chosen over another type of research method due to the small number of participants, their busy schedules, and above all, to eliminate any potential political tensions and judgements of putting together different participants. Also, some participants do not fully align with the given classification of the tables, as some of them are neighbours and academics (who participated in the design), or neighbours and members of the agencies involved. However, they were placed in their corresponding group as they had a more significant role in such areas.

This political background may explain the low participation of authorities and political representatives. The contribution of these type of participants were important due to their decision making power around the projects. For both projects, more authorities were contacted, but most of them did no reply to the emails or phone calls. This fact represents a knowledge void in the research as the perspective of valuable participants is missing, but at the same time provides information about the lifespan of projects and the political influence.

The number of participants was defined by the actors who agreed to participate. Creswell (2014) suggests that the number of interviews should be between 20 and 30, which was achieved for the Magdalena River case. The number was slightly short for the Xochimilco case. Thereby, some additional fieldwork was performed aiming to find more participants, but very few people knew about the project, making them unfit to participate. However, some perceptions of the local community were gathered during the visit to the site (see Fieldwork).

The interviews were conducted without major problems; just two of them finished rapidly at the interviewees´ request because of their limited time availability (RM14 and PUX01). Other interviews displayed the political background of certain actors in the area, as some participants (RM16, PUX08 and PUX15) inflated the information about how they are involved in the sites in the present time while ignoring the researcher questions. Despite being complicated interviews, these participants eventually

contributed to creating part of the narrative of the projects, but it is important to say that these interviews displayed the existing political interests in the studied areas.

During this second stage, two interviews were performed with experts in water management, which contributed to creating a broad perspective on water management in Mexico. These two interviews complement Table 3.3 Problem recognition interviews and also contributed to design the framework in Chapter 5. These two interviews are briefly described in Table 3.6.

Table 3.6 Problem recognition interviews (Second Part)

Interview	Experience
E	Former experience in the Water Agency (CONAGUA) Queretaro Branch and currently in IMTA
F	An international NGO (World Wide Fund for Nature) working in Water Reserves (Reservas de Agua)

Fieldwork

Commonly, fieldwork is a term used to describe the observation work in any kind of site, community, or institution (Daly, 2007). In this case, the fieldwork involved visiting the sites where the projects were developed to corroborate what the interviewees described and triangulate the obtained information. The visits helped to appreciate the urbanisation growth and the pollution of the water bodies. In the case of the Magdalena River, the visits allowed sight of the construction and work developed as part of the restoration project (plazas, lateral drainage and the current state of the river). In Xochimilco, the opportunity to talk with some residents emerged, corroborating that people know that Xochimilco is recognised as a UNESCO site, but do not understand what it represents exactly, nor the existence of a management plan.

All the visits involved walking around the sites and see their current conditions. The observation developed in the Magdalena River was passive as the focus was to see the natural condition of the river and the elements constructed during the restoration project. In the case of Xochimilco, as with any work or construction implemented, the focus here was to understand the existing water management in the area and to find more participants for the interviews. The observation was more active, involving interaction with local people aiming to understand how they use water and whether they knew about the UNESCO management plan. Some of the conversations were recorded through notes, and five talks were recorded digitally after verbal authorisation. This information is not presented here due to lack of formal consent, but it was useful to create a robust contextual understanding of the site.

Photographs and field notes were taken to illustrate facts that the interviewees point out as a matter of interest. Also, pictures were taken of the things that were particular or unknown to ask informally to interviewees about specific artefacts or physical condition of the sites. Hence, it helped to corroborate

the information from interviews and documents. Field notes accomplished a similar task while allowing to record further thoughts, perceptions and reflections.

Seven field trips in total were made to the sites, carried from November 2016 to January 2017. Here, it is important to state that this is the annual dry season in Mexico City. One visit was carried in the Magdalena River upper basin (natural forest and Dynamos Park) and another in the lower-urban basin. Some parts of the trajectory of the river were not possible to follow because there are houses on the river-banks or it was forbidden as was the case near the *National Security and Research Centre* (CISEN). Also, the Eslava River was visited in the Conservation Land. For Xochimilco, field trips were made to two touristic wharves, Caltongo and Cuemanco, and to two original towns, San Luis Tlaxialtemalco and Mixquic. Three of the field trips were performed with the participants RM17, PUX09 and PUX10 as they volunteered as guides during the interviews. The description of this fieldwork is further described in Table 3.7.

Table 3.7 Fieldwork description

Project	Location	Date	Duration	Characteristics
RM	Eslava River	December 10th	4 hours	This visit was executed to see the condition of the Eslava river in the conservation area (*Parque Ejidal San Nicolas Totolapan*). This visit was useful to witness the condition of the river.
	Magdalena lower basin	December 13th 2016	3 hours	Observations of the river condition from Emilio Carranza to Santa Teresa Road. This trip helped to see the works performed in the river as part of the restoration project. This visit was shorter than intended due to the poor access to the river-bank.
	Magdalena Upper basin and Dynamos Park	January 15th 2017	6-7 hours	Fieldwork from the Fourth Dynamo to *Puerta del Cielo* in the forest. This visit allows seeing the condition of the river in the recreational area and how the recreational infrastructure still spreading upstream. In these areas, it is possible to see the infrastructure created for the industry that flourished during the 19th century. Fieldwork was done with RM17.
PUX	Mixquic	November 9th 2016	8 hours	As part of the *7th Chinampas Conservation and Cultural Landscapes of the Mexico City Seminar-Workshop (UAM), a* field trip was organised. Here, a historian talked about the conflict that exists between towns concerning water and how lousy management has made some springs dry. This area has a more rural character, but it is visible in the urbanisation process and the pipe system that irrigates the channels.
	San Luis Tlaxialtemalco	November 19th 2016	6 hours	Visit the core of the UNESCO declaration and saw the current practices that are developed in the agricultural area, such as *chinampas* stalking and greenhouses. Here, two peasants talked about what they are doing. PUX09 showed the area and explained that the peasant that complained about the government used to receive grants from agencies. The second peasant talked about how he does the planting, stating that he uses freshwater (supplied by pipes) for the poinsettias as he is afraid to lose the plants for the lousy quality of the water of the channels.
	Caltongo	November 26th 2016	2 hours	Visit the touristic area and witnessed the excessive number of boats that exist in the area for touristic purposes. A conversation with a canoeist took place before taking a ride in a boat with PUX10. This visit was important to understand the dynamic between urbanisation, touristic development and the natural characteristics of the area.
	Cuemanco	December 30th 2016	2 hours	This wharf is in better condition (less urbanised). A canoeist mentioned how Ecological Park is in bad condition and how they had to put barriers to stop losing water that goes into the park.

Qualitative data Analysis

Qualitative data analysis is an essential process of the investigation, as this stage is when the gathered information becomes meaningful, exhibiting new concepts and knowledge. Daly (2007) expresses that the analysis process helps researchers to transcend from descriptions, through to the creation of categories, properties and their relationships, and contribute to the theory. Miles *et al.* (2014) describe that this process assists researchers in developing cognitive maps that illustrate complex interactions and events. However, the analysis process requires the fragmentation and identification of data (Daly, 2007). Descriptions and data categorisation facilitate the data management, as they allow to reduce vast data into analytic units (Miles *et al.*, 2014) while permitting the recognition of concepts and relationships between variables (Eisenhardt, 1989). This is an iterative process of systematically comparing the information, through emergent concepts or constructs, while questioning how these concepts relate to the data, hypothesis and other emerging concepts (Eisenhardt, 1989). Data become meaningful through an interpretation process that evolves from this analytical process (Daly, 2007). Eventually, ideas become themes while threads and patterns are recognised, comprising a clear picture (Synder, 2012 referenced in Cleary, Horsfall & Hayter, 2014).

This research is based on a **case-oriented approach** (Ragin, 1987 referenced in Miles *et al.*, 2014), so its analysis focuses on assembling the case entirely and then comparing the two cases. Hence, each case was analysed using the chosen frameworks and the **Qualitative Thematic Analysis**. This type of analysis allows researchers to capture meaning complexities while identifying implicit and explicit ideas in the data (Guest, MacQueen & Namey, 2012). Braun & Clarke (2006: 79) define Qualitative Thematic Analysis as "*a method for identifying, analysing and reporting patterns or themes within data*". It identifies important information as themes and concepts, allocating patterns about meaning.

The analysis was performed through reviewing documents, field notes and interviews and coding the information. The coding process allows for allocating concepts and linking raw data to them for later analysis (Guest *et al.*, 2012). Coding can be a flexible approach as it allows the categorisation of information in two manners, using an inductive (bottom-up) and deductive-theoretical (top-down) method. In the inductive approach, themes emerge from the data analysis process while the deductive approach uses concepts taken from theory and it is driven by the researcher's interest in the area (Braun & Clarke, 2006; Lindson *et al.*, 2009). Braun & Clarke (2006) state that the inductive approach is still confined to patterns/themes evolved around the interview questions, so the researcher determines them.

In this research, the first coding stage was a deductive approach that used the main concepts of the literature (i.e. landscape, regime and niche-innovation) and the Nvivo software. Newspapers were displayed in chronological order setting a direction to display the rest of the data. Reports were compared and coded, studying which objectives and process from early reports were kept and achieved in the final reports. Nevertheless, final reports were not conclusive, leaving some gaps about the execution of the project, making the researcher rely on on-site visits. Then, information was summarised and written up.

After this stage, the need to adapt the selected framework and refine the concepts used for coding was recognised. Hence, the previous summary was re-coded, using the codes extracted from Loorbach (2010) and Smith & Raven (2012). This is further explained in Chapter 4 and Chapter 5.

A second analysis was done while re-coding main reports, master plans and the interviews, using the second codes (deductive approach). This can be considered a *Simultaneous Coding* (Miles *et al.*, 2014) as two different codes (from two frameworks) were applied to a single qualitative data set. Here, the data were coded using matrices, a tool used to display and condense information using tables (Miles *et al.*, 2014), intersecting data according to codes and data origin (i.e. interviewee or literature reference). Two extracts of matrices used for this research is shown in Annexe F (p. 283). Then, a sub-coding process (inductive approach) was conducted, separating quotes or text according to different characteristics of each case. As an example, if the main code was infrastructure, the sub-code was hydrological infrastructure, environmental infrastructure for conservation or related works and recreation infrastructure, among others. In the hydrological infrastructure, a subsequent coding separated water supply, drainage and wastewater treatment. The summarised information from the first coding process was put together with the information from the second coding in a matrix, eliminating repeated codes or topics. Here, an extenuating analysis was done where the researcher took many decisions as some topics overlapped different codes, so several iterations of analysis and depuration processes were performed until a comprehensive storyline was achieved. Here, newspapers, documents and field trips notes were retaken to fill doubts and information voids. The analysis process is shown in Figure 3.3, displaying the iterative process of coding, scrutinising and writing, which characterises the qualitative data analysis (Braun & Clarke, 2006). This process was performed for each case.

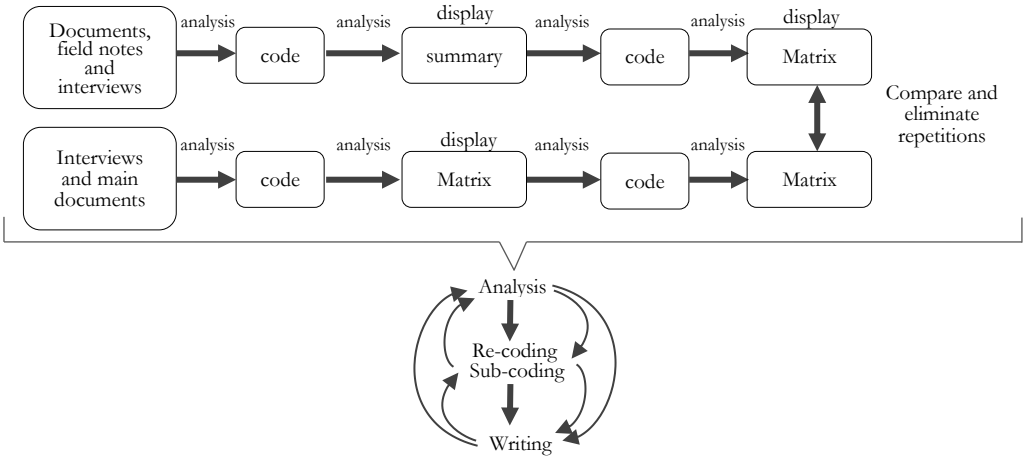

Figure 3.3 First analysis process.

Then, a cross-case analysis was performed for each framework, and then they were combining in a third framework, see Figure 3.4. Crossing cases or comparing cases, allows the researcher to do general and deeper assumptions while reassuring that described explanations are not merely individual conjectures (Eisenhardt, 1989; Miles *et al.*, 2014). According to Miles *et al.* (2014), cross-case analysis facilitates the recognition of themes and cause-effects processes. This analysis aimed to understand similarities and differences between the two projects, internal processes and dynamics between the projects and the regime, unravelling patterns and themes. A new process of inductive coding process was performed, recognising codes that apply for the two cases, analysing the data in an iterating manner and developing themes. Themes comprise codes (concepts) to express broader content, like observations and interpretations of the phenomena (Swain, 2018). Here, it is important to emphasise that particular interest was set over institutional capability (or behaviours), political constraints, power and knowledge, and how these three themes interact within each other creating lock-in mechanisms.

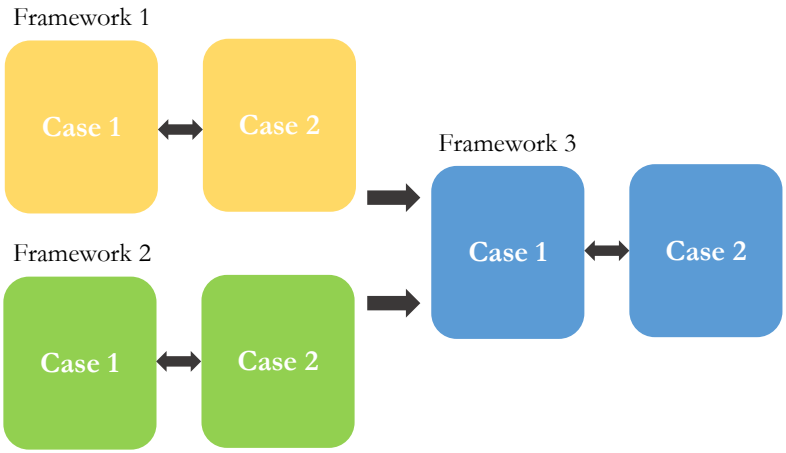

Figure 3.4 Second analysis process: Cross case examination.

Through this analysis, the data was continuously interrogated studying how it relates to the whole information while developing a comprehensive story of events, identifying main actions, cause-effects and significant problems. This analysis defined a broad picture for each case, finding particular problems and concerns. Then, crossing cases allowed the recognition of patterns and similarities, displaying behaviours of the water system.

3.4 Ethical and safety considerations

The ethical concerns were considered low risk as most of the participants were asked about non-personal matters. Some issues were considered as possible, such as creating false expectations with the participants because some of them believe that international academic research would create world-wide awareness of the studied sites. Here, it was explained to the participants that this was just an academic project,

which demonstrated communication limitations. Communication of the findings was offered to allow participants to use the information if relevant.

Another consideration is whether participants can be identified or possible issues when dealing with participants´ data. Interviewees were anonymised during the analysis, and the data was managed under the Data Protection Act 1998. Participants were informed about the research before the interview, explaining to them that it was academic research and that they were free to leave the project at any time if they found it upsetting. Participants granted their permission to be recorded. All the procedure was previously approved using the UCL Research Ethics Committee Guidance (Annexe G, p. 285).

Participants selected the venue to be interviewed, some of them chose neutral venues, like coffee shops, offices or universities, while others selected their homes. Researcher safety measures were considered and previously approved through a Risk Assessment Form Field/Location Work (Annexe H, p. 290).

3.5 Limitations of the Methodology

This thesis recognises that there are some methodological limitations, which according to Feyerabend (1975), is inevitable in research. This section describes the main limitations faced by this research concerning three main categories: research design, data collection and data analysis. Table 3.8 summarises the limitations encountered in the methodology, explaining the issues related to each category and the problems that produced in the research. Some measures were contemplated to reduce these issues, which are further explained in this section.

Table 3.8 Research limitations

	Category	Limitations	Problems produced in the research
1	**Research design**	A limited number of case studies	Not enough information to create generalisations
2	**Data collection**	A limited number of participants with a similar perspective	Bias information towards specific topics
		Narrative research affected by the individualistic point of view	Information influenced by individual perspectives
3	**Data analysis**	Single researcher	Limited discussion and feedback. Data analysis bias by individualistic perspective

1. Limitations in the research design

   This research has as the main limitation in the number of cases as it only uses two. Here, it is important to recognise that there are considerable debates in the relation of the number of case studies requested for rigorous research, mostly as the case-study is frequently used to create new theory (Yin, 2018). This assumption is supported by Gray (2004), who considers that a small number of cases studies is not enough to create generalisations and assumptions, while Eisenhardt (1989) argues that a considerable number of cases are needed to create valid research. On the other

hand, Dyer & Wilkins (2011) contemplate that the number of cases is not important as single cases studies have been able to provide enough new knowledge, because the primary goal of a case study is to create *rich* descriptions while revealing the deep social structure of behaviours. Eventually, this assumption was challenged by Eisenhardt (1991), who complained that detailed description can create confusion as researchers may develop false expectations of acquiring new knowledge, which may lead to distorting and inaccurate theory. Therefore, methodological rigour and multiple cases are necessary.

Few cases are common in the case-oriented approach, as the focus is on delivering in-depth information, and thus a restricted number of cases (Ragin, 1987 referenced in Miles *et al.*, 2014). However, in this research, the number of selected cases was defined by the total amount of existing projects that can illustrate the relationship between established and new practices (regime-innovations). Despite the existence of drivers introducing sustainable practices, insufficient advances have been achieved in the water management domain, even in the developed world (Brown & Keath, 2008). Therefore, not all the existing projects could reach a level of strength or momentum that can exemplify such dynamic between practices.

This research recognises that the selected two cases deliver the opportunity of learning from previous projects, which may release new knowledge on how to implement sustainability in Mexico City. The low number of cases reduces the number of variables to make generalisations, but this was compensated by *rich* descriptions that reveal cause–effects while illustrating some behaviours that may not become evident when dealing with a broader number of cases.

2. Limitations in the data collection

There was a considerable effort in contacting diverse participants for the interviews, but it became easier to contact and arrange interviews with participants who had a relationship with previously interviewed participants that recommended them. Thereby, some information was similar between different participants as they tended to have similar points of views, having interchanged information before their participation, or having faced the same experience. This produced a level of saturation that can happen in this type of research; however, participants with contrary perceptions were unwilling to participate, such as authorities and politicians. Here, Christensen & Jensen (2012 referenced in Cleary *et al.*, 2014) supports that a homogenous group of participants can provide richer information as they focus on fewer topics, as different participants can have different perspectives delivering a broader set of topics, which complicates the analysis. Additionally, this also suggests that the stakeholders who did not participate were not properly engaged in the project while the interviewed participants maintained a greater interest in the project or the related site. Hence, their perspective may be broader than a person who participated in the project but paid no attention to it. Zamora-Sáenz (2013) already recorded this phenomenon in his

PhD Thesis, which was developed during the Magdalena River project. According to this researcher, some participants had forgotten about their involvement in the project, although they participated in previous stages (i.e. workshops). As a mitigation measure, this research triangulated the data from interviews with reports and newspaper articles, aiming to have a comprehensive description of the events for each case. Additionally, fieldtrips fulfilled the gaps that emerged during the data collection process

Narrative research is used in this investigation. Individuals use storytelling to make sense of their experiences, but this story can be constructed in many ways and interpreted in many others, having an individualistic approach (Daly, 2007). In this sense, Snyder (2012, referenced in Cleary *et al.*, 2014) suggests that some interviewees tend to respond assuming specific roles and power, so they deliver what they think is the right answer or what the interviewer wants to hear. This generates further implications in the research credibility, which can only be mitigated through the researcher experience (Salmon, 2013). This research acknowledges such limitations, but also recognises that participants' perceptions are crucial in unravelling information, such as behaviours and causes that are not evident at face value, but instead recognised through a reflexive process. Thereby, the triangulation of data from different sources became relevant.

3. Limitations in the data analysis

Interviews were coded by only one researcher, increasing the possibility that the results of the qualitative analysis are biased due to the researcher's individualistic perspective and experience. According to Miles *et al.* (2014), this influence in the result is undeniable as the authors suggest that interviews and other qualitative data method are not objective as they are restricted by the researcher interpretations, who frames words according to their concepts, ideas and experiences. This research reduced the researcher's influence through a rigorous Qualitative Thematic Analysis, the clear definition of codes and the iterative process. Additionally, the use of the literature about Mexico City and Transition Theory was used to compare and validate the analysed data.

3.6 Strategies for research quality

Some considerations and strategies were considered to mitigate the methodological limitations and increase the research quality. However, these considerations have to contemplate the qualitative research approach and the limitations of this type of research. This is supported by Cutcliffe & McKenna (1999) who consider that qualitative research requires certain deliberations, differing from quantitative research, due to the endemic characteristics of this study that involves the construction of the reality by the researcher. Korstjens & Moser (2018, based on Lincoln and Guba, 1985) define that quality in qualitative research needs to involve at least the following four principles: credibility, transferability, dependability

and confirmability. These principles were taken as a guideline to set strategies to achieve quality in this research. These principles and related strategies are summarised in Table 3.9.

Table 3.9 Strategies for research quality

	Criteria	Strategies
1	**Credibility**	▪ Standardising the methods and analysis (i.e. same questions) ▪ Data triangulation from different sources ▪ Narrative description of events ▪ Visual display tools ▪ Cross-cases and cross-variables analysis (matrices) ▪ Iterative process ▪ The consultation phase of member checking. Some participants checked the research findings
2	**Transferability**	▪ Tick description of the cases ▪ Positioning research findings within the existing literature.
3	**Dependability**	▪ The theory guide the inquiry. ▪ Audit Trial or *´memoing'* ▪ Photographs ▪ Notes
4	**Confirmability**	▪ Positioning research findings in the literature about Mexico City ▪ Positioning research findings in the literature about Transition Theory ▪ Conversations with experts in the field

1. Credibility is the equivalent to *internal validity* in quantitative research and relates to the assurance that the research findings are accurate (Korstjens & Moser, 2018). Credibility can be constructed using rigorous methods, such as using the same questions and the same protocol in data gathering and analysis. Also, a process of triangulation can create credibility (Yin, 2018), as data from different sources corroborate the veracity of the information (Appleton, 1995 referenced in Cutcliffe & McKenna, 1999). Despite there being three types of triangulation in regards to using a variety of methods to analyse the data or involving diverse participants (Smith and Biley, 1997, referenced in Cutcliffe & McKenna, 1999), this research focuses on triangulation through comparing a variety of data from different sources.

   Another strategy was the evaluation of causal-effects between different variables (Yin, 2018), through a narrative description of events, visual display tools and the use of matrices to cross variables and cross-cases (Daly, 2007; Miles *et al.*, 2014). Also, the iterative process of reading, analysing and reviewing the concepts increased the credibility of the findings (Korstjens & Moser, 2018). Credibility was enhanced by inviting a participant highly involved in the project to review the case report, as recommended by Yin (2018). This research included a consultation phase in 2019, whereby two participants highly involved in the cases were invited to read and comment on the results (RM01 on November 5th, 2019 and PUX05 October 9th, 2019). Then, the two frameworks (Transition Management and the Socio-Technical Regime Alignment and Processes) were compared to match similarities and make adjustments. A particular emphasis

was given to the first framework (Transition Management) that studies the project development and of which the results are more comprehensive to the participants.

2. Transferability relates to the applicability of the research or when the research can be transferred to other studies (Korstjens & Moser, 2018). This term is similar to the concept of *external validity* used by Yin (2018), who suggests that the findings of the study can be generalised to other cases or situations. Transferability can be similar to reproducibility and replicability, referring to re-collecting the data and finding similar or the same results. A criterion that is even difficult to define in quantitative research (Patil, Peng & Leek, 2016). However, Salmon (2013) suggests that replicability is impossible in qualitative research, especially when using semi-structured interviews, as it would involve replicating conversations. Similarly, Cutcliffe & McKenna (1999) explain that even in the analysis process it is unlikely that different researchers interpret the data in the same manner, as the coding process (creation of themes and categories) is a particular creative process related to each researcher. Thereby, Korstjens & Moser (2018) suggest that transferability can only be possible through using a *"thick description"* of the phenomena, to facilitate the reader to assess whether the findings are transferable to another setting. Hence, this research focuses on creating a comprehensive story-line ("*thick description")* of the cases and reviewing the existing literature.

3. Dependability relates to the stability or consistency of findings through time (Korstjens & Moser, 2018). Here, existing valid theory guided the inquiry and an *Audit Trail,* or a series of notes taken during the data collection and analysis, recorded the research path as the ideas (preliminary findings) that were emerging in every step of this process. Glaser and Strauss (1967 referenced in Cutcliffe & McKenna, 1999) refer to these sequential notes as *´memoing'* of crucial thoughts and lines of enquiry. Here, photographs and notes taken during the fieldwork are considered part of the Audit Trail.

4. Confirmability relates to the neutrality of the research, so it focuses in evaluating whether the findings evolved from rigorous analysis, and whether they are grounded in the data and based on the literature (Korstjens & Moser, 2018). This term is comparable to *reliability* as it focuses on concerns related to the interpretation of the data (Yin, 2018) and the trustworthiness of results (Daly, 2007). This research strengthens its confirmability through positioning the findings in the existing literature about Mexico and Transition Theory (Eisenhardt, 1989; Yin, 2018). Additionally, some meetings were arranged to discuss the finding with some experts in the field (November 2019-May 2020)

3.7 Summary

This research concerns relate to the replicability and the validity of the methods. Qualitative research with a case-study approach and Qualitative Thematic Analysis delivers the flexibility to use Transition Theory to answer the research question. Some considerations had to be considered in the research design, especially in applying a rigorous and standardised protocol to the methodology, methods, and the iterative analytical process. Additionally, this research recognises that the field of sustainable transitions can be intricate and complex, involving a vast number of variables and interrelations. This complexity can be reduced using a theoretical framework that allows the researcher to distinguish a selected number of variables to facilitate the analysis process and to focus on the variables that answer the research question.

Chapter four

4 Theoretical Framework

This research proposes a modification in a Theoretical Framework to understand water management transitions in Mexico City. Here, it is recognised that Transition Theory has benefits in explaining this phenomenon but falls short in explaining the dynamics in incumbent-led transitions and the role of the regime´s actors in transitions. Section 4.1 presents the Transition Theory while explaining its central concepts and issues. Section 4.2 describes the Multi-level Perspective (MLP), which suggests that existing dominant practices change due to external pressures. Section 4.3 introduces how transitions can be managed and induced through experiments. Then, the proposed Theoretical Framework is introduced in Section 4.4, taking notions from the previous mentioned theory and concepts. This chapter finalises with a summary in Section 4.5.

4.1 Theoretical lens and Transition Theory

Several notions emerged to study environmental problems, such as the *Tragedy of the Commons*, which explains that there is a natural resource management issue because only one or few actors receive the benefits of using resources despite the cost being shared by all the stakeholders. Hence, resources tend to be over-exploited (Corral-Verdugo *et al.*, 2002; Hardin, 1968). Then, the Institutional Analysis and Development (IAD) framework proposes that actors solve the commons´ dilemma through institutions or governing systems that influence performance, behaviours and actions (Adeoti, 2019; Ostrom *et al.*, 1994; 2011, referenced in Afroz, Cramb & Grunbuhel, 2016). The Socio-Ecological Systems (SES) describes how ecological systems are interwoven with social and institutional systems, and this combination produces diverse outcomes, like resource degradation (Ostrom, 2007, 2009). However, Interviewee C states that the problem in Mexico City is the lack of political will in introducing a change. Thereby, the suitability of choosing a theory that focuses on the resistance to change of the powerful actors involved in the established system, especially when a series of reasons can influence this political will (Persson & Sjöstedt, 2012). Transition Theory has been frequently used to described sustainable transition problems while taking some approaches from the Institutional Theory and the system perspective (Loorbach *et al.*, 2017). Furthermore, this theory can help to focus on the regime or water system as a unit of analysis.

Innovations and Transition Theory

Innovation is the perception of the newness of any knowledge, practice or artefact. No matter how long the existence of an idea, if it is new for an individual, it becomes an innovation (Rogers, 2003). However, it also embraces the notion of change. Wehn & Montalvo (2018) describe that there can be two types of innovations: (1) *Incremental Innovation* that is characterised by small changes that aim to improve technology, products, processes, services and organisations, and (2) *Radical Innovation* that is disruptive and tends to destroy perceptions, competencies and jobs. Here, the problem is that sustainability mostly relates to radical innovations, which are hardly accepted due to the lack of market, external costs that no one wants to pay (such as measures to avoid pollution) and because the beneficiaries of it are not always the users or the manufacturers (Schaltegger & Wagner, 2011; Van Den Bergh, Truffer & Kallis, 2011). Thereby, sustainable innovations need governmental support and a series of procedures that can only be done through political processes (such as changes in the law and economic support/tax reductions) that legitimise the innovations (Meadowcroft, 2011; Smink *et al.*, 2015).

The importance of innovations is that they are adopted, which require a diffusion or a communication process, where the innovation is shared while reaching the members of a social system who have a mutual understanding of the innovation (Rogers, 2003). This is a process where innovation is altered by the behaviours and norms of the social system, while the social system also changes (Rogers, 2003). However, sustainable innovations, due to their radical character, require further changes in the social

system, such as radical, large-scale and integrated changes (Van Den Bergh *et al.*, 2011). Hence, it can be stated that the adoption of a new and sustainable idea involves a sustained process of change in the structural characteristics of the society, which is call *transition* (Rotmans *et al.*, 2001). Transition is also described as large-scale collective changes that emerge to solve outstanding collective challenges, like fulfilling specific social needs (Berkhout *et al.*, 2010; Loorbach *et al.*, 2017) or address water scarcity.

Transition Theory emerged to study such substantial and long-standing changes in the social structures that are necessary to adopt innovations while embracing the idea that desirable changes can be induced or guided (Elzen & Wieczorek, 2005; Farrelly & Brown, 2011; Loorbach *et al.*, 2017; Rotmans *et al.*, 2001; van-Herk *et al.*, 2013; Wen *et al.*, 2015). This theory has been highly used to explain why a specific technology is adopted while it provides a framework to understand new discourses, ideas and forces that drive changes in societies (Geels, 2011; Grin *et al.*, 2010). First, it is important to understand that transition happens when new technology and social innovations occur at the same time, which means they co-evolve. Therefore, it is a socio-technical and co-evolutionary process (Raven *et al.*, 2010). These interwoven changes are necessary when aiming to achieve transitions towards sustainability, as it is necessarily new knowledge or technology, as well as the society adopting such new information (Fuenfschilling & Truffer, 2014; Whitmarsh & O'Neill, 2010). Second, the transition involves systemic and complex changes and long-term processes, while conveying substantial variations of the societal needs (de Haan *et al.*, 2011; Geels, 2011; Rotmans *et al.*, 2001). Therefore, a transition implies simultaneous transformations in different domains or systems, such as technology, economy, institutions, behaviour, culture and belief systems, reinforcing the alteration of one another (Lawhon & Murphy, 2011; Rotmans *et al.*, 2001). Also, sustainable transition implies disruptions and changes in areas or systems that are regularly reproduced and reinforced by actors, industries, policymakers, politicians, consumers, civil society, engineers and researchers (Geels, 2011). Therefore, sustainable transitions are difficult to achieve because such systems tend to remain stable while minimising any deviation because they are also embedded within the organisational culture and reinforced by routines, practices, technologies or values (Fuenfschilling & Truffer, 2016). These systems are supported by the existing social *status quo*, making it difficult for any disruption to happen, or it may occur in extended periods, such as years or decades (Rotmans *et al.*, 2001).

Transition Theory is difficult to conceptualise, and thereby some frameworks emerged to assist it in illustrating the transition processes. The most common framework is the Multi-level Perspective that provides a heuristic structure for conceptualising, ordering and simplifying the analysis of complex inter-connected variables and large-scale transformations (Kelly, Ellis & Flannery, 2018; Lawhon & Murphy, 2011; Rauschmayer, Bauler & Schäpke, 2015; Smith, Voß & Grin, 2010; Wells & Nieuwenhuis, 2012).

4.2 Multilevel Perspective

The Multilevel Perspective (MLP) is a visualisation tool or framework that distinguishes the temporal aspects of transitions and three different levels: landscape, dominant regime and niche-innovations

(Lawhon & Murphy, 2011; Smith *et al.*, 2010). These three levels are in constant tension and opposition, stimulating changes in the other levels (Wells & Nieuwenhuis, 2012). Here, a transition is considered as a shift from one regime (socio-technical system) configuration to another, and this only occurs through the right interplay of variables between the three levels (Fuenfschilling & Truffer, 2014; Raven *et al.*, 2010; Turnheim & Geels, 2012). The external landscape or exogenous context restrains and exert some pressure on the dominant socio-technical system or regime (Fuenfschilling & Truffer, 2014). Alternative systems around innovations emerge in protected sub-levels or *niches*, where they can mature and become institutionally capable of competing with the established regime while executing some pressure in the system (Geels, 2002). Figure 4.1 represents transitions clearly because they are dynamic and multi-dimensional processes (Rotmans *et al.*, 2001). Geels (2002) describes that landscape changes are slow (thick green lines), while the regime comprises several dimensions or sub-regimes, which are stable while co-evolving within each other. However, the internal tensions of the regime or the landscape pressure (dotted green line) may disrupt the regime (short blue diverted arrows). Meanwhile, innovations are developing but are not yet established. If the innovations can stabilise (bigger red arrows), they may create pressure in the regime and take advantage of the disruption, this can then result in the innovation being established as part of the regime while influencing the external landscape (Geels, 2002).

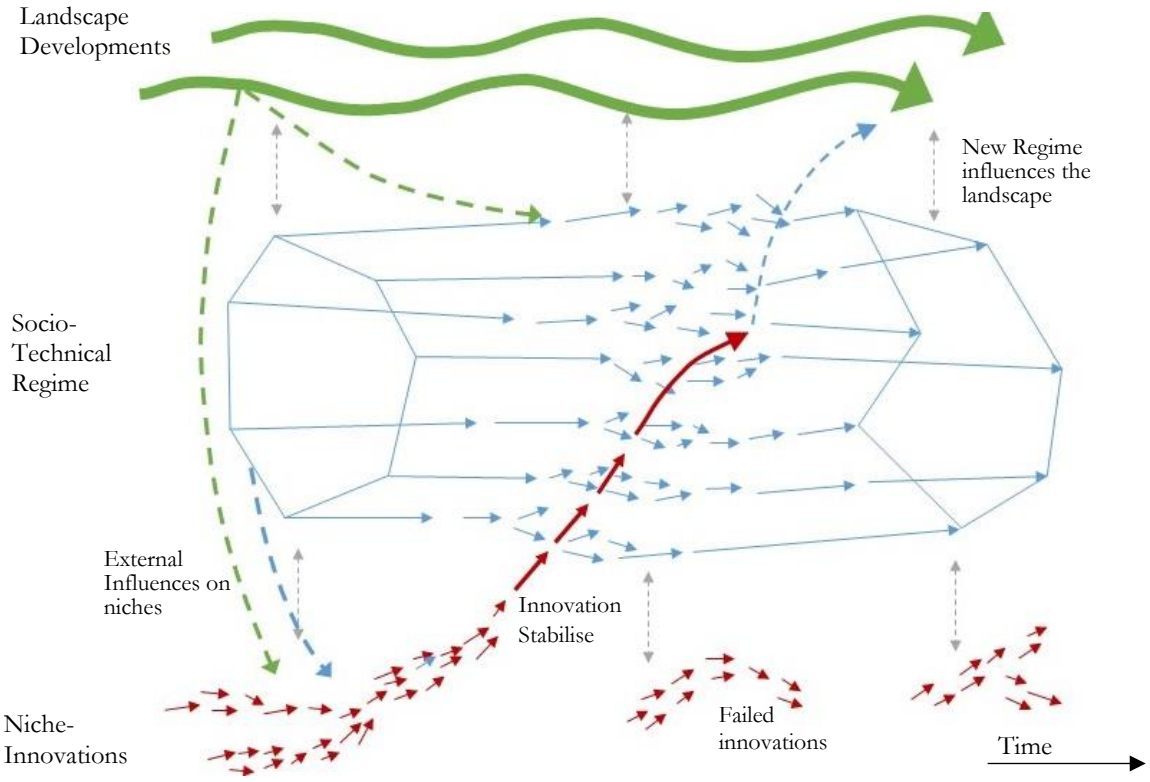

Figure 4.1 Dynamic multi-level perspective
Source: Geels (2002: 1263) and Loorbach *et al.* (2017: 606).

However, changes and transitions are difficult to achieve due to the levels of structuration, especially as the higher or broader the level, the higher its stability, and thereby, its resistance to change (Foxon & Pearson, 2008). Hence, the landscape and the regime are very stable and difficult to disturb. Romero-

Lankao & Gnatz (2013) mention that the most common pressures likely to destabilise the regime are (1) conflicts that emerged around access to resources and (2) exogenous burdens that produce reactive changes, such as resource depletion or disasters. In the same manner, these authors comment that there must be an innovation for executing pressure, which can range from niche-level experiments, governmental or grassroots initiatives that aim to reduce uncertainties of the natural world (Romero-Lankao & Gnatz, 2013). Thereby, experiments play an important role in the transitions as they demonstrate innovations and the related supporting configuration (or a novel socio-technical configuration, such as IUWM), seeding the ideas for change (Berkhout *et al.*, 2010; Raven, 2006; Raven *et al.*, 2011; Smith & Raven, 2012; Torrens *et al.,* 2018). Raven *et al.* (2011) make a distinction between regime projects and niche experiments. The first ones are constrained and selected by the regime and the landscape, while the seconds are protected by the niche due to the radical innovation and the considerable contradiction they represent to the regime. Still, these are restricted by the regime and the landscape but partially. These two types of experiments are shown in Figure 4.2.

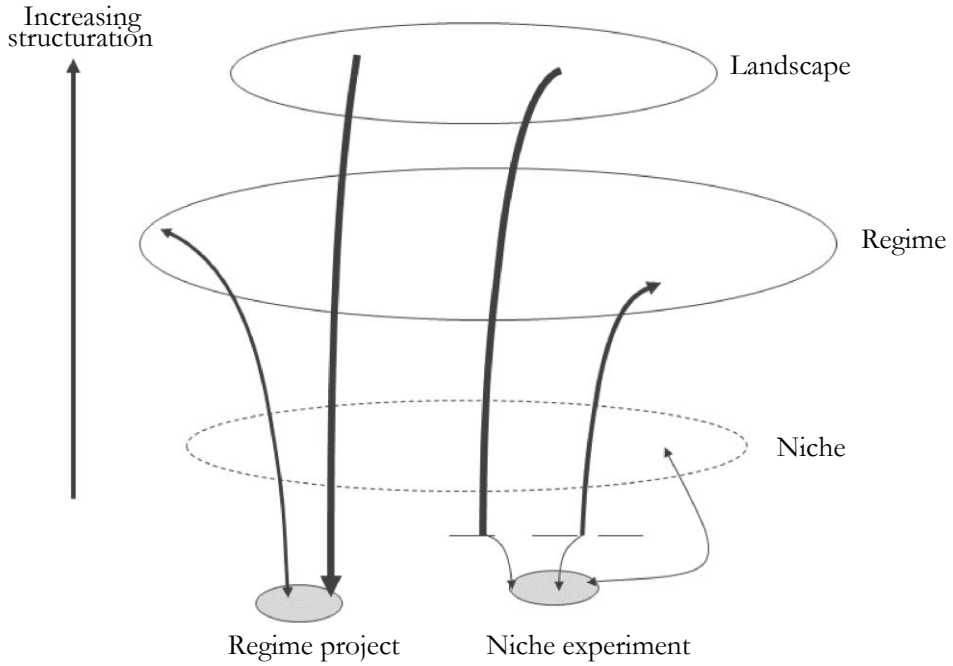

Figure 4.2 The Multi-Level Perspective
Source: Raven *et al.* (2011: 1066).

Niches are necessary to allow innovations to co-evolve within markets, technologies and institutions while allowing the niche actors to nurture innovation and protect it from early rejections and uncertainty (Grin *et al.*, 2010; Raven *et al.*, 2010; Raven *et al.*, 2011; Smith & Raven, 2012; Smith *et al.*, 2010). Also, it has been recognised that actors who form the regime or incumbents can guide transitions and experiments while lobbying for the policy and regime transformation (Stenzel & Frenzel, 2008). These two types of transitions can be specified through understanding the *Transitions Pathways* that illustrate

four trails that innovations follow to complement or replace the regime. These pathways are summarised in Table 4.1, where the first three paths describe the routes for the niche-innovation evolution, while the last one illustrates the incumbent-led transition or regime transformation.

Table 4.1 Transitions Pathways
Adapted from Geels (2011) and Grin *et al.* (2010).

Pathways	Description
Reconfiguration	Niches are adopted to solve local problems, which then trigger subsequent adjustments in the architecture of the regime.
Technological Substitution	Innovations and niches replace the regime when landscape pressures happen
De-Alignment and Re-Alignment Path	A major landscape pressure de-aligns the regime causing several niche-innovations to emerge. Eventually, a re-alignment process occurs around one innovation, leading to a new regime
Transformation	The regime adopts some innovation characteristics, but alternative innovation does not breakthrough

Transformation happens due to external pressures from the landscape level or outsider social groups, and a gradual adaptation of the existing regime (Berkhout *et al.*, 2010). Also, the innovation has not yet fully developed when landscape pressures occur. Thereby, some regime actors can modify the innovation path and activities, leading to the gradual adjustments of the regime trajectory (Geels, 2011; Grin *et al.*, 2010). This can be complemented by Berkhout *et al.* (2010) that describe that transformation also occurs when the socio-technical regime is emerging from the old regime through accumulative little modifications.

The MLP has some limitations (Geels, 2002) and it has been criticised for being over-simplistic and short in representing the complexity of the chaotic reality (Smith *et al.*, 2010), especially as it is overused to describe historical factors but tends to be applied unsystematically (Genus & Coles, 2008). Additionally, the level definition of the MLP is problematic, making difficult to define the boundaries of the three studied levels (niche, regime and landscape), especially, because the scale tends to become blurry in the context of globalisation and regionalisation (Raven *et al.*, 2012; Smith *et al.*, 2010). Hence, it tends to be highly influenced by the researchers perspective of what they consider each level or each level tend to be conflated with territorial boundaries, which commonly lead to incorrect assumptions (Raven *et al.*, 2010, 2012). Therefore, Raven *et al.* (2010) recommend using this framework as an analytical approach rather than a real entity.

Major criticisms claim that the main problem of MLP is the lack of sensitivity and the limited consideration to the political dynamics, power struggles or how power prevents the introduction of any change (Geels, 2010; Genus & Coles, 2008; Lawhon & Murphy, 2011; Meadowcroft, 2011; Raven *et al.*, 2012; Shove & Walker, 2007; Smith *et al.*, 2005; Turnheim & Geels, 2012; Wieczorek, 2017). Therefore, scholars and researches highlighted the limited use of the MLP in the developing world, especially as it contemplates the state as a vital part of the transition, because it encourages and facilitates sustainable evolutions, but this fails to be the case in most of the developing countries (Elmustapha, Hoppe & Bressers, 2018; Lawhon & Murphy, 2011; Verbong *et al.,* 2010). These criticisms have overshadowed the

study the role of the regime in sustainable transition in the developing world, giving little emphasis on how regime´s actors induce changes and participate in experiments, especially as experiments have also been considered necessary in comprising niches, as being the starting point (Berkhout *et al.*, 2010; Romijn, Raven & de Visser, 2010). Thereby, the development of experiments by the regime actors can illustrate the beginning of the transition dynamics, where some tensions started to influence the regime, and some experiments are developed, as shown in Figure 4.3.

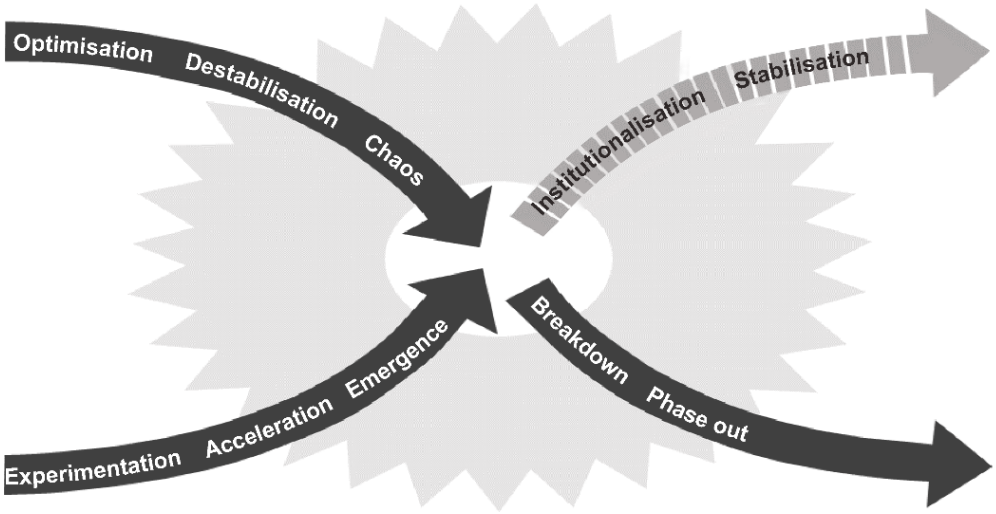

Figure 4.3 The X-Curve of Transitions
Source: Loorbach *et al.* (2017)

Figure 4.3 represents the moment when a transition occurs, or the regime is transformed by emerging alternatives into a new regime (grey arrow). Also, it shows how pressures raised through overtime and the regime that self-reinforced through optimisation destabilises (upper black arrow), while changing agents (lower black arrow) accelerate transformations that started as experiments, helping to visualise the transformation process (Loorbach *et al.*, 2017). Still, it is important to understand further each level of MLP to recognise the restrictions to change and how innovations can breakthrough.

Landscape

The External Landscape or Socio-Technical Landscape involves the material and immaterial elements at the macro-level (Rotmans *et al.*, 2001). It has also been defined as *"the technical, physical and material backdrop that sustains the society"* (Geels & Schot, 2007: 403). Therefore, it comprises different rationalities within a society, such as practices, assumptions, values, beliefs and rules (Fuenfschilling & Truffer, 2014). Landscape factors continuously produce and reproduce the material existence of an individual, while influencing both innovations and the regime (Fuenfschilling & Truffer, 2014; Geels & Schot, 2007; Quezada, Walton & Sharma, 2016).

The landscape can easily shape the subsequent levels as the most disruptive forces emerge in here, creating pressure on the regime and an opportunity for transitions to happen. Changes at this level occur at a very slow pace due to its high structuration, but abrupt changes can also happen as a result of economic crises (i.e. oil crises in the 1970s), political coups or natural disasters (Drinkwaard *et al.*, 2010; Quezada *et al.*, 2016). The poor strength of stakeholders in influencing the landscape is well recognised, despite Raven *et al.* (2012) suggesting that this may occur after actors and practices influence the regime, and then, the landscape. Thereby, the broad scope of sustainability studies through the transition approach (Hansen & Nygaard, 2013; Jasanoff, 2018; McLellan *et al.*, 2016; Soma & Polman, 2018; Zeppini, 2015).

The MLP perspective uses this level to describe the factors that influence the niche and regime specific context rather than a container (Lawhon & Murphy, 2011). For Smith *et al.* (2010), these influences range from demographic and environmental changes to social movements and shifts in political ideology, economics, scientific and cultural paradigms. Still, some researchers like Geels (2012, referenced in Gazull *et al.*, 2019) and Rotmans *et al.* (2001) consider the landscape in its literal sense, contemplating the demographic growth, the urban environment, structures and the community among other variables, while other researchers consider the state (governance and policies) as supporting factors of sustainable practices (Rock *et al.*, 2009; Wehn & Montalvo, 2018). In this particular research, the landscape model of Kern (2012) is used as it syntheses the landscape pressures in four variables: Macroeconomic Trends, Socio-Economic Trends, Macro-Political Development and Deep Cultural Patterns, while also includes the contextual variables that play a fundamental role for the innovation development.

Regime

Transition Theory implies that regimes are the combination of human (actors and institutions) and material elements (artefacts and technology) that create socio-technical working configurations that satisfy societal needs (de Haan *et al.*, 2011; Grin *et al.*, 2010; Smith *et al.*, 2005). Complementing this definition, de Haan *et al.* (2011) describes that there is a broader system (i.e. energy, food or transport system) where all the related services or subsystems related to the primary necessity are involved. Henceforth, the *water system* comprises water supply, sewage and drainage systems among other sub-systems related to water, and the regime is the most powerful or dominant socio-technical organisation that fulfil such sub-systems, like commonly is the centralised and piped water supply in many countries around the world (de Haan *et al.*, 2011; Grin *et al.*, 2010). The regime sets the dominant rules, artefacts and infrastructures, dictates the way that problems and solutions are conceptualised and addressed, while it is supported and reproduced by incumbent social networks and institutions (Grin *et al.*, 2010; Lawhon & Murphy, 2011; Raven *et al.*, 2011).

The normal evolution of a regime is towards improving its social role and satisfying better societal needs (de Haan *et al.*, 2011). However, regimes are very resistant to alterations because their structures are highly institutionalised and aligned into specific logic and routines, which mainly focuses on specific

technologies. Hence, engineering practices and technologies tend to co-evolve within the logic and organisation of the socio-technical system, shaping the system configuration as well (Foxon & Pearson, 2008; Fuenfschilling & Truffer, 2014). Geels (2011) and Smith & Raven (2012) describe these systems as permanent structures because they are reinforced by their own set of rules[4] and sub-system interactions, alignments and mutual interdependencies. That means, regimes comprise sub regimes, and each one represents different social groups and rules, making each one distinctive and somehow autonomous, but they continuously interact and co-evolve adding more stability to the regime as a whole (Geels, 2011; Genus & Coles, 2008). These sub-regimes are shown in Figure 4.4, representing knowledge, industry, technology, users' practices and market, socio-cultural domain and policy.

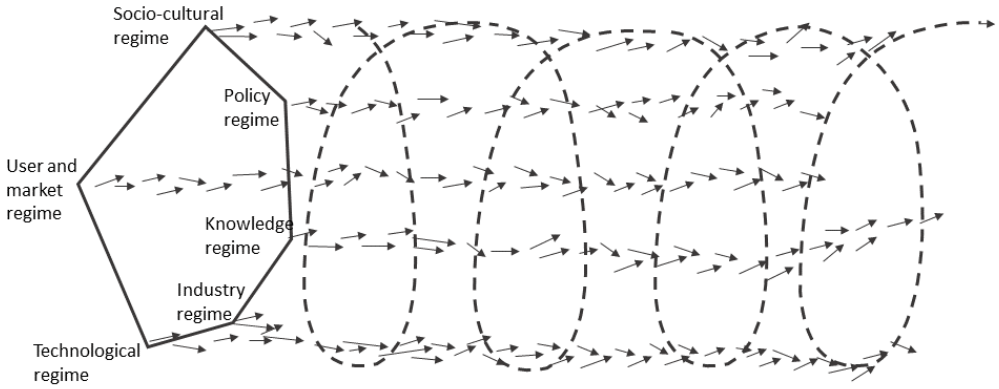

Figure 4.4 Alignment of ongoing processes in a socio-technical regime
Source: Geels (2011:27) and Smith & Raven (2012).

Regime resistance is also the result of the co-evolutionary accumulation and alignment of knowledge, investments, infrastructures, values and norms that shaped the consumption habits (Smith *et al.*, 2010). This resistance can be defined as *'path dependency',* which implies certain decisions made in the past created a long-term impact that continues to influence present behaviour (Seppala & Katk, 2009). Foxon & Pearson (2008) and White (2017) describe that path dependency occurs due to established practices that self-reinforce while generating returns or positive feedback of other domains (such as markets, the economy of scales, policies, learning effects, expectations, network or co-ordination of industry and users, etc.), and this results in the *'lock-in'* of a prevailing trajectory. Turnheim & Geels (2012) explain that lock-in and path dependency are usually accompanied and reproduced by resources, commercial transactions and economic environments; legitimacy (a product of political and public support); and endogenous trust in the viability of the regime. In other words, common practices are well established and a series of other mechanisms that are also well-established support these practices, so a change in one domain implies an upscaling series of changes.

[4] Here, the set of rules are the medium and the outcome at the same time. Rules are created by actors who simultaneously are influenced by such rules (Geels, 2011).

Also, the regime is broader than the industry sector and its supply chains, as it embraces institutions networks, regulation, markets, relations with users, availability of information, political visions and social expectations (Smith *et al.*, 2005, 2010). Thereby, the regime destabilisation is challenging to make it happen, so a change in a regime requires a series of alterations in several domains (technology, markets, organisations and institutions, among others) while affecting inherent competences (Wehn & Montalvo, 2018). Hence, a change is more likely to happen when different pressures align, affecting different dimensions of the regime (Turnheim & Geels, 2012). Still, external pressures need to exist to disrupt the regime (one-directional influence, Geels, 2014), while the regime faces an internal process that pushes internal changes to occur within its structure, which is commonly known as bi-directional destabilisation (Rauschmayer *et al.*, 2015; Turnheim & Geels, 2012).

This research follows the research line of Smith *et al.* (2005) that describes how transformation involves the interplay of resources and power to align pressures and coordinate assets (or responses) to allow changes in the regime. Hence, transitions can be considered a governance process as changes can be directed towards the desired direction. According to these authors, the interplay between available resources (create knowledge, influence direction and create markets), within the strong adaptive response (distribution of resources, the interdependency of regime members and favourable economic-legal framework) can create different transition contexts. Smith *et al.* (2005) demonstrate that transition can be well directed by the incumbent actors instead of just responding to external pressures. Despite that Smith´s *et al.* (2005) research creates an opportunity to complement regime transformation within Transition Management, it is less well studied how the regime´s internal pressures emerged when dealing with a transformation process, like assuming it is a smooth process. This study can be complemented with a proposal of Augenstein & Palzkill (2015), which created a framework that studied how the regime reacted within the transformation process, focusing on the discourse of transformation. The richness of this study is that it illustrates that regime transformation is an internal process, where internal and external pressures are translated and negotiated towards creating a goal (while reframing new problems, pathways and solutions) and translating into actions in the different regime dimensions, like the ones shown in Figure 4.4. This framework can be useful to understand regime acting through experiments as a response to pressures, but it fails to comprehend better the internal dynamics of the regime. Raven & Verbong (2007) have recognised that regime dimensions play a different function in changing a regime, being in some cases the industrial and the institutional domain the main promoters of the change. Still, there are limits in the research about how each sub-regime reacts towards external and internal pressures led by innovations.

New regimes emergence has been given some credibility. Raven & Verbong (2007) have previously studied the case when new technologies need to create a new system, focusing on developed countries. They recognised that new regimes create reactions in already established systems. This is because changes in the regime can involve incremental innovations or radical innovations. The radical innovations involve

a structural change in the regime and regime boundaries may cross, linking different parts of multiple regimes, such as actors and production chains while transforming the regime (Konrad, Truffer & Voß, 2008; Raven & Verbong, 2007; Smith *et al.*, 2005). The interaction of regimes has been studied by Raven & Verbong (2007) that distinguish three complementary interactions between regimes: (1) regimes cooperate and achieve mutual benefits, (2) separated regimes integrate and become one and (3) rules are transferred from one regime to another. These authors recognise that it is also common the competition between multiple regimes fulfilling similar functions or competing for the same resources, creating certain tension in them. However, the emergence of regimes or transformation is complicated due to the competitive disadvantage of this new regime (Raven & Verbong, 2007). Different regime interaction has taken relevance in transition studies around the late 2000s, as described by Konrad *et al.* (2008). This may be the approach to understand the systems and regimes in developing countries, as suggested by van Welie *et al.* (2018).

Regimes in the developing world are highly complex, as stated in Chapter 2. Furlong (2014) believes that the whole system or sub-system configuration comprises multiple regimes (formal and informal) complementing each other. Van Welie *et al.* (2018) describe that the problem is that these regimes tend to miss alignments internally and between other configurations. These authors use the term of *sectoral regime* to illustrate sub-systems, such as water supply, which comprises several *service regimes* or the means to satisfy the service (i.e. centralised and piped water supply, wells, rain harvesting, pipe-trucks and river diversions, among others). However, sectoral regimes tend to be *"splintered"* in the global south because the service regimes are weak, their dimensions are not established and are poorly aligned internally. It is important to have in mind that this weakness is related to the regime capability but also can be related to the regime self-reconfiguration, which can be emerging, transforming or a niche is gaining power, as suggested by van Welie *et al.* (2018).

Regime emergence or regime destabilisation has been broadly studied to encourage transitions. However, according to Hansen & Coenen (2015) and Raven *et al.* (2012), more studies are needed as most of the research sees this entity as monolithic and heterogeneous, without considering the local variations of these structures. This research focuses on studying the regime while taking Smith & Raven´s (2012) *Alignments and Processes of the Socio-Technical Regime* model to investigate the water system through the dimensions proposed. This model recognises that the regime characteristics create lock-in processes and path dependency that translate into a series of pressures (or selection environment) over the innovations. Table 4.2 summarises the model displaying the six sub-regimes that comprise the regime as their main attributes or characteristics.

Table 4.2 Alignments and processes of the socio-technical regime.
Source: Smith & Raven (2012)

Sub-regimes or dimensions	Selection pressures towards changes
Industrial structure	Organisation networks, industry boards, user-producer relations, shared routines, capabilities, resource allocation procedures labour force, capabilities, etc.
Technologies and infrastructures	Material environment, technical standards and infrastructural arrangements and requirements, etc.
Knowledgebase (scientific)	The knowledgebase is directed towards increasing the knowledge line through formal research programmes, review procedures, established journals, paradigms, etc.
Users relations and markets	Market institutions, rules, supply and demand, price mechanisms, user preferences and routines, etc.
Public policies and political power	Administrative regulations, policy networks, policy guiding principles, power relationships, etc. Here, political power maintains the *status quo* (through jobs, taxes, and votes):
Cultural significance and associations of the regime	Widespread symbolic representation, appreciations and cultural values.

This research recognises that some modifications are needed in this model due to the local variations found in Mexico City. Hence, this model is further described in Chapter 5 within variations that complement the theoretical framework.

Niche

Niches emerged supporting and protecting innovations (which are commonly technological innovations) and grow developing a structure similar to the regime. Therefore, niches are potential regimes but yet not established (Fuenfschilling & Truffer, 2014; Geels & Raven, 2006; Smith *et al.*, 2005). Smith & Raven (2012) describe how niches develop specific logics and mechanisms to protect the innovation according to each regime´s sub-dimensions or sub-regimes, while the niche actors perform considerable cognitive, institutional, economic and political work (Raven *et al.*, 2010; Smith *et al.*, 2010).

The niche configuration has an evolutionary process. First, innovations emerge from a dynamic process, where different actors, knowledge flows and the market interact to create a new technology or knowledge (Foxon & Pearson, 2008). Geels & Raven (2006) describe that innovations emerge creating and aligning expectations and visions about their functionality and the future. Expectations will be shared and eventually translated into project development, comprising goals, specifications, requirements and tasks. Second, expectations alignment creates institutionalisation and eventually, enrolment of actors will grow, creating networks and including potential investors, such as actors from mainstream settings, as from the regime itself (Raven *et al.*, 2011; Smith *et al.*, 2010). This whole process creates social legitimacy and learning (Smith *et al.*, 2010). Actors attract resources (such as money) while creating protected spaces (niches or incubators) to develop new projects and related tasks, allowing innovations to grow and mature (Fuenfschilling & Truffer, 2014). After the innovative design has been established, powerful actors have joined the support network and consecutive changes occurred (pieces, price, technology and a market niche has been created), innovations can break through and leave the niche (Geels & Schot, 2007). The niche protection fades away, the innovation gains momentum and diffusion, becoming

competitive against the regime (Grin *et al.*, 2010; Raven *et al.*, 2010; Rotmans *et al.*, 2001; Smith & Raven, 2012). However, innovations after a breakthrough can fail to replace the regime. This commonly happens when the incubation time is too short for consolidating innovations, the contextual factors and material resources are underestimating, or there is minimal involvement from outsiders or regime actors in the innovation (Feola & Nunes, 2014; Grin *et al.*, 2010).

The previous definition establishes that niches are networks of actors working in a specific geographical context, or they are pre-existing actors' mobilisations (Smith & Raven, 2012). The definition of niche can be complemented with Niche Development Literature (especially Strategic Niche Management, Geels & Raven, 2006; Hodson *et al.,* 2008; Raven *et al.*, 2011), which recognises that there is not just a single local configuration of actors developing projects but a socio-cognitive structure that incorporates shared rules, expectations and visions, known as *global niche* (Raven, 2006; Raven *et al.*, 2011). Hence, there is an interaction between *local and global niches. Local Niches* develop experiments through borrowing visions and concepts from the *global niche* (and from experiences of previous and similar projects), adapting them through specific context (Hodson *et al.*, 2008). Then, a feedback process starts when lessons (new knowledge, rules, designs, user preferences and regulations) are translated from the project to the global-niche, making it more visible and stable while creating a technological trajectory (Geels & Raven, 2006; Hodson *et al.*, 2008; Raven, 2006; Raven *et al.*, 2011; Torrens *et al.*, 2018) as shown in Figure 4.5. This feedback process may not permeate back to the *global niche*, but according to Hodson *et al.* (2008) projects can contribute in the local embedding process as lessons may produce a change in both technology, design and local context, creating social learning[5].

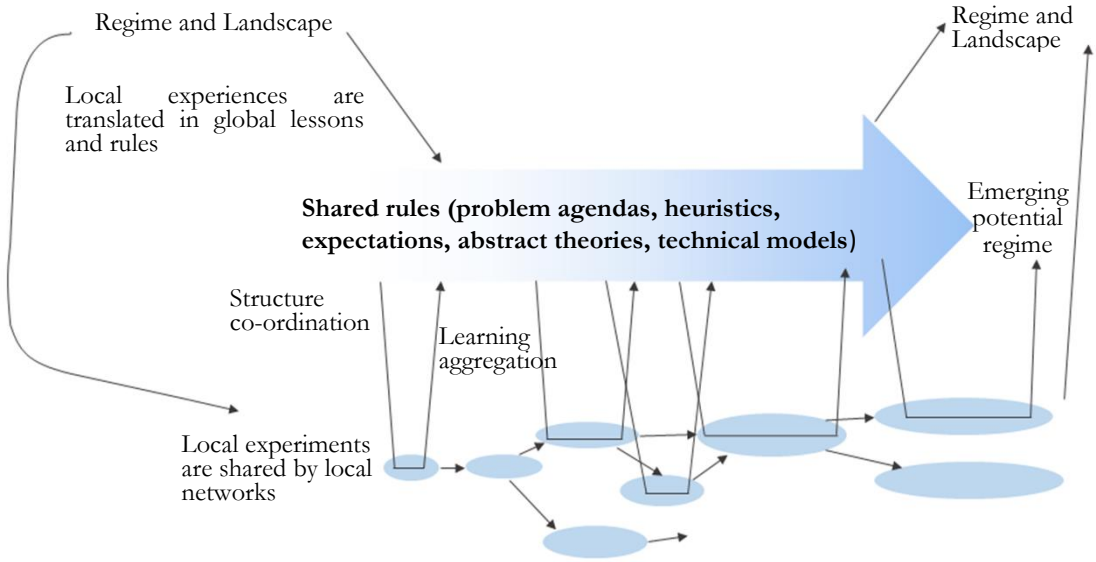

Figure 4.5 Local projects and the global niche
Source: Raven *et al.* (2011)

[5] Raven *et al.* (2010) describes social learning as the process where multiple actors develop an alternative outlook of the real world.

Experiments can represent the earliest stage of the socio-technical learning process, as suggested by Berkhout *et al.* (2010). They can start from the local interpretation and articulation of expectations, visions and rules of the *global niche*, attracting resources and the attention of stakeholders that may comprise networks or *local niches* (Geels & Raven, 2006; Hodson *et al.*, 2008; Torrens *et al.*, 2018).

4.3 Managing innovations

Innovations have been studied to facilitate their management and adoption. Considerable attention has been placed in the development of innovations in the form of experiments, as they are initiatives that exemplify new socio-technical configurations reinforcing advances towards desirable directions, like sustainability (Berkhout *et al.*, 2010; Bos *et al.*, 2013; Smith & Raven, 2012; Torrens *et al.*, 2018). The objective of experiments is to reduce uncertainty, test ideas and diffuse the innovation while creating long-term visions and transition pathways (Berkhout *et al.*, 2010; von Wirth *et al.*, 2019). Besides providing direction to the niche-innovations, experiments create capabilities, expertise and the ability to learn about social challenges and transitions (Hodson *et al.*, 2008; Raven *et al.*, 2010; Turnheim, Kivimaa & Berkhout, 2018).

Studying how to guide transitions to desirable directions and produce changes in governance, social scientists and policymakers have developed Transition Management (TM) and Strategic Niche Management (SNM) as analytical and normative frameworks (Raven *et al.*, 2010). Loorbach & Raak (2006) describe that these two frameworks represent tools for integrated analysis which can lead to innovation management and new policy. SNM focus on the internal processes of the niche-innovation (alignment of expectations, network formations and learning process as described by Elmustapha *et al.*, 2018; Raven *et al.*, 2010). However, SNM has been criticised as it is highly concentrated on the technical artefact of transitions (Raven *et al.*, 2010). Therefore, Transition Management (TM) became more suitable for this research as it focuses on social transitions, displaying a considerable interest on societal problems and the transformations of systems, such as the water system (Loorbach & Raak, 2006).

Transition Management (TM)

Transition Management has been designed as a governance approach for guiding transitions, leading regime transformations through practical experiments and experiences (Bos *et al.*, 2013; Genus & Coles, 2008; Loorbach, 2010; Smith *et al.*, 2005). The value of this approach is that it recognises that societal actors can influence complex societal issues and governance processes because transitions require social changes in the complex interaction of individuals, organisations, networks, and socio-technical systems, as nonlinear changes in stable regimes (Loorbach, 2010).

Transition Management has been considered as an operational policy-approach and an instrument to support a participatory process that guide desired and sustainable changes in the long run while creating

structural changes in the complex societal system (Loorbach & Raak, 2006). In other words, TM is a process of participatory visioning, learning and experimentation, that proposes scientific activities to define societal problems and direct solutions while creating new governance (Bos & Brown, 2013; Kelly *et al.*, 2018; Loorbach & Raak, 2006). TM aims to influence and empower civil society, so communities become active participants in introducing sustainable practices in their context (Rauschmayer *et al.*, 2015).

Likewise, Transition Management has been recalled as an analytical framework that combines complex systems theory and empirical experiences (Loorbach, 2010; Raven *et al.*, 2010). TM creates a robust framework to understand how changes are introduced by societal actors and enhance subsequent transitions (Genus & Coles, 2008; Rauschmayer *et al.*, 2015). This approach embraces the MLP perspective, as it conceives transition as the interplay between the three existing levels and dynamical changes that mutually impact and reinforce each level transformations (Kelly *et al.*, 2018; Loorbach & Raak, 2006). Thus, the role of the regime takes a critical consideration because it can be influenced in the long run, but in the meantime it reacts and fights against innovation and related actors, adding problems and consequences into the research (Loorbach & Raak, 2006).

TM has several characteristics that can be beneficial to study transition and its complex interaction. TM is simultaneously a multi-domain, multi-temporal and multi-actor network approach, allowing the study of how different systems coevolve in periods up to 25 years while involving diverse actors who influence each other, as well as the transition process (Kelly *et al.*, 2018; Loorbach & Raak, 2006). Additionally, it states some *governance processes* or activities that allow guiding changes while unravelling the multiple pathways to influence socio-technical transitions and various solutions to solve societal problems and enable a sustainable future (Bos & Brown, 2013; Bos *et al.*, 2013; Loorbach, 2010).

Here, the Transition Management Cycle is the framework that allows recognising the *governance processes* and patterns to induce transitions through a cycle of learning and actions that comprises four steps. The first step refers to establishing a transition arena (or multi-actor network organisations) to set discussions about a specific theme, problem definitions and establish the conditions of such arenas, for example, the stakeholders or frontrunners. The second step states the development of a long-term vision and common transition agenda (goals and objectives/or transition path) while mobilising the transition networks. The third step is the steering process that includes the execution of experiments and related actions. The fourth and last step recognises the monitoring and reflection (learning/evaluation) of the transition process, which should result in the adjustment of the agenda and visions as preparation for the next transition round (Bos & Brown, 2013; Kelly *et al.*, 2018; Loorbach & Raak, 2006). These stages are shown in Figure 4.6.

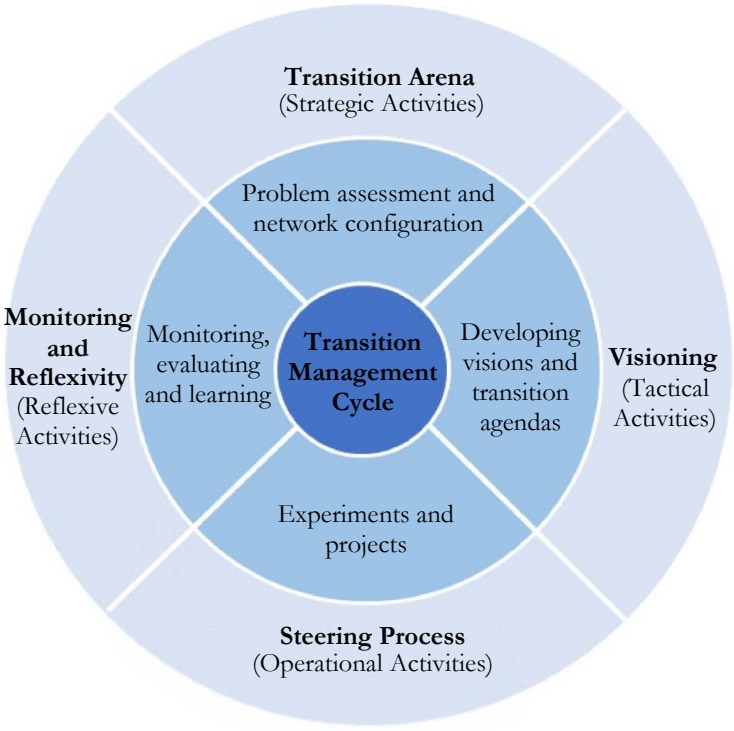

Figure 4.6 Transition Management Cycle.
Source: Kelly *et al.* (2018).

Loorbach (2010) describes that the Transition Management Cycle does not state a fixed order of activities; it just helps to visualise a logical order of the required activities to produce new governance. The Transition Management Cycle can be translated into four different types of *governance activities* (or *spheres*) that are required to induce a transition or new governance. These activities are strategic (envisioning), tactical (negotiating), operational (executing) and reflexive activities (Loorbach, 2010). Loorbach & Raak (2006) describe that each main activity or sphere is related to specific types of actors, instruments and sub-activities. Moreover, Loorbach (2010) emphasises that monitoring and reflection should go along with each one of the three previous activities within a final reflection. These activities are further explained in Table 4.3.

Table 4.3 Transition Management governance activities
according to Loorbach (2010)

Spheres (governance activities)	Strategic	Tactical	Operational	Reflexive
Concept	Activities related to the societal system culture	Steering activities to produce a change in the structures (regime and societal system)	Experiments and actions	Monitoring, assessments and evaluation
Sub-activities	• Vision development • Strategic discussions • Long-Term Goal Formulation • Collective Goal and Norm Setting • Debates on norms and values	• Defining activities for future experiments • New patterns and structures (rules and regulations, institutions, organisations and networks, infrastructure, and routines) • Involved stakeholders, networks and coalitions	• Experiments and actions • Behaviours and practices that introduce or operationalize new structures, culture, routines, or actors.	• Activities related to monitoring, assessments and evaluation • Activities for new governance and learning

There have been considerable criticisms about the limited outlook that Transition Management has on politics and struggles of power (Bos & Brown, 2013; Genus & Coles, 2008; Shove & Walker, 2007). Experiments tend to convey conflicts and power struggles (Smith *et al.*, 2010) because they are formulated through negotiation processes (Castro, 2007). TM obscures the process of negotiation, deciding goals, participants and the way to participate (Rauschmayer *et al.*, 2015), especially as it has been recognised antagonisms and power struggles in the *transition arenas* (Hopkins & Schwanen, 2018; Lawhon, 2012). Hence, there is a conflict in what Shove & Walker (2007: 766) describe *"when and how to decide and when and how to intervene"*. Therefore, Kelly *et al.* (2018) recommend considering the role of power-holders, governments and political circumstances within any transition process. Lawhon & Murphy (2011) contemplate that power can illustrate the social and political background that creates the knowledge and technologies that maintain the regime or transforms it. Also, these authors recommend recognising the role of power in decision-making (or Transitions Management negotiations) and that such decisions convey costs, benefits and impacts that do not affect the population in the same manner, creating political and power struggles. Thereby, a constant questioning about *who has power* should be included as suggested by Lawhon & Murphy (2011) while also tracing the antagonisms that emerge in each stage.

Also, for Loorbach & Raak (2006), the Transition Management ambition of introducing a change makes it vague and complicated. TM involves high uncertainty in decision making, such as "*how to identify early signs or trajectories that take decades to unfold*" (Shove & Walker, 2007: 767). Rauschmayer *et al.* (2015) state that defining sustainability, goals and knowledge targets as part of the transition process is highly complicated, and so, also the methods to assess the proposed objectives. This is complicated because

sustainability, as a concept, is contested and difficult to define (Fahy & Rau, 2013; Khoo, 2013). Additionally, all the actors have different concepts of how to achieve sustainability (See Chapter 2).

Therefore, this work incorporates power and related struggles as a variable aiming to recognise when the political struggles emerge and influence the project, and somehow, allowing the recognition of some contextual characteristics. Also, this research incorporates two variables that can assist in evaluating the vagueness and complexity of the projects and transitions. These variables emerged from the collected data, as they were recalled as problems in the development of the project, which they are: (1) the coherence of goals, definitions and concepts used in the experiment design and their translation towards consequent activities, and (2) the involvement of the stakeholders, networks creation and the communication of knowledge in each stage of the TM cycle. These two variables evaluate the continuity of the project through different phases and explain the limited involvement of the community in Transition Management approaches in the global south, highlighted as a problem in the literature (Silvestri *et al.*, 2018; van Welie & Romijn, 2018).

Another aspect that is important to contemplate is that the main result expected of this approach is to recognise what has been learnt. Kelly *et al.* (2018) describe that learning is fundamental because it helps to adjust in the vision, agenda and coalitions, and so, the possibility to start the Transition Management Cycle again. Then, this learning allows projects to be repeated consequently (broadening) and scaled (scaling-up) (Grin *et al.*, 2010; Loorbach, 2010; Raven *et al.*, 2010). The analysis of the *Reflexive Activities* can be complemented by Turnheim *et al.* (2018) that make a distinction between the outputs and outcomes of the experiments and which can relate to the first and second-order learning concepts described by Elmustapha *et al.* (2018). First-order learning encompasses the accumulation of data and information, so outputs relate to tangible results that range in the following six categories: diffusion or new visions, technological, infrastructural, policy and institutional, business and citizen behaviour (Kivimaa *et al.*, 2017 referenced in Turnheim *et al.*, 2018). Second-order learning involves the active participation of the actors reflecting and adapting cognitive frames and reformulating expectations. Thereby outcomes involve broader results that are necessary to achieve transitions, such as (1) learning something new, (2) enabling and sustaining a systemic change or (3) reconfiguration of collective political and institutional order, which influences the governance domain (Turnheim *et al.*, 2018). Therefore, some of these experiments receive the name of governance experiments, mainly as they aim to reconfigure capacities, resources and agencies (von Wirth *et al.*, 2019). This research focuses on the reconfiguration of the political and institutional order but values any knowledge that may have contributed to consecutive experiments or transitions.

The Transition Management Cycle helps to understand the project development. At the same time, the three proposed variables aim to encounter the problems that may have emerged through the development of the project, while opening the notion to recognise what has been learnt, significantly influencing the local governance and subsequent projects. These variables are allocated within the activities of the TM cycle in Table 4.4.

Table 4.4 Transition Management and added variables
based on Loorbach (2010).

Spheres or governance activities	Sub-Activities	Added Variables
STRATEGIC	• Vision Development • Strategic Discussions • Long-Term Goal Formulation • Collective Goal and Norm Setting • Debates on Norms and Values, Identity, Ethics, Sustainability or important themes for society	• Power struggles • Conceptual Issues • Stakeholders
TACTICAL	• Steering activities that are interest-driven and relate to the dominant structures (regime) of a societal (sub-) system • Established patterns and structures (rules and regulations, institutions, organisations and networks, infrastructure, and routines) • Stakeholders dealing daily with developing programmes, financial and institutional regulation and frameworks	• Power struggles • Conceptual Issues
OPERATIONAL	• Experiments and Actions • All Societal, Technological, Institutional and Behavioural practices that introduce or set new structures, culture, routines, or actors	• Power struggles • Conceptual Issues • Stakeholders
REFLEXIVE	• Assessments and Evaluation (experiments and actions) • Governance Processes (ongoing policies and societal changes)	• Power struggles • Conceptual Issues • Stakeholders • Lessons Learned

TM has been recognised as useful in addressing problems driven by the lack of consensus about the problem definition and the possible solutions, such as what is happening in urban water management (Bos & Brown, 2013). Additionally, it has been used to analyse incumbent-led transitions. Hopkins & Schwanen (2018) recognise that this framework is useful to create niches for experimentation and test technology.

The TM activities and sub-activities can be useful to understand the projects development and their institutionalisation but fails to see external influences or recognise the constraints that experiments generate in incumbent actors and organisations. The MLP create a preliminary view of how transitions are induced, but very few projects have illustrated incumbent-led projects dynamics. Hence, a framework was proposed from the notions of the MLP, focusing on the dynamics of the regime when incumbents promote an alternative project.

4.4 The adapted framework

Previous sections illustrate that *local niches* can be absent when regimes face transformations or the transition process is being initiated through the development of some experiments that may comprise niches. Berkhout *et al.* (2010) describe that experiments need protection through some funding, policy or institutional structure. Here, incumbent actors play a fundamental role in creating this protection. Some studies can be useful to describe the behaviour of incumbents. Smink *et al.* (2015) recommend

tracing power in incumbent-led transitions. This can be complemented by Avelino & Rotmans (2011: 798) who describe power *"as the capacity of actors to mobilize resources to achieve a certain goal"* while considering that transitions are the dynamical interplay of power between actors. Hence, power can illustrate the transition trajectories by describing the dynamics between the regime, sustainable experiments and related actors. Avelino (2017) describes that different power dynamics occur according to the power that actors have, as one actor may have power over another, one has more or less power than the other actor or power of different actors may have no relation to each other. These dynamics describe if there is cooperation, competition, co-existence, synergy, antagonism and neutrality between actors, besides a dependence-independence relationship. However, these dynamics have not fully considered that the regime needs to debilitate or lose certain structuration power to embrace a change. This can be complemented by Fuenfschilling & Truffer (2014, 2016) who describe how institutional logics (practices, assumptions, values, beliefs, and rules developed around diverse rationalities) become stronger, highly structured or institutionalised while restricting changes. Hence, the dominant institutional logics need to weaken, debilitating the structuration of the system, so the regime becomes heterogeneous and increases the possibility of change, while a different logic gains power (Fuenfschilling & Truffer, 2014). This illustrates the regime´s internal power dynamics while allowing to recognise that institutional or regime power should be incorporated in the power dynamics.

Power has been recognised as a fundamental matter in transition literature (Smith *et al.*, 2005) as power dynamics often prevents the introduction of sustainable transitions, especially in the developing world (Lawhon & Murphy, 2011; Meadowcroft, 2011; Romijn *et al.*, 2010; Shove & Walker, 2007). However, Avelino & Rotmans (2011) take the conceptual term of *"power"* as neutral, which may erroneous when studying the global south. Jaglin & Zérah (2010) criticise that the apolitical methodology can lead to an incorrect interpretation of the developing city that comprises different characteristics and power structures (i.e. formal/informal, connected/unconnected, rich/poor, and so on) and many in-between combinations. An extensive set of literature describes that water becomes immediately political once it enters into the city while shaping the uneven distribution of flows between classes, reinforcing inequality and exclusion of a considerable sector of the population to whom the service is denied (Bahri, 2012; Gandy, 2004; Kaika, 2005; Putri, 2017; Swyngedouw, 2004, 2006). Hence, cities produce and reproduce political and economic processes that involved a conflict between citizens differentiated in class, ethnicity and gender, among other types of exclusion. Here, some citizens strive to conserve the *status quo* while others struggle to create new urban environments (Angelo & Wachsmuth, 2014; Heynen, Kaika & Swyngedouw, 2005; Swyngedouw, 1996, 2004). This has contributed to forming diverse and fragmented societies, characterised by interest groups competing for urban resources (Jaglin, 2005 referenced in Jaglin & Zérah, 2010). Unequal access to water raises questions about who decides and why (Ernstson & Swyngedouw, 2019; Heynen, 2013; Heynen *et al.*, 2005; Holifield, 2009), which eventually translates as there are not neutral decisions when scarce resources are involved. Thereby, it is difficult to separate the term political from power in water management transitions.

As a summary, power and distribution of resources can be useful to understand transitions. The regime´s internal power dynamics can be traced through recognising the activities that execute incumbent actors to maintain the power or distribute it to empower changes while recognising the political influences. Experiments can illustrate the role in the power interchange, as they are indeed a process of actors being empowered or disempowered, favouring new forms of knowledge and procedures (Evans *et al.*, 2016; Moglia & Sharma, 2010; von Wirth *et al.*, 2019). Following Avelino & Rotmans (2011) idea of understanding the changing dynamics between actors and power, this is illustrated through the interactions between regime and experiments, especially in experiments developed by the regime´s actors. Furthermore, the studied cases demonstrate that there are dynamics between incumbents and projects´ actors, especially when the project is promoted by incumbents, representing that it is challenging to delimitate the level where the actors belong. Hence, this thesis takes the liberty of bending the MLP framework, allocating the project within a direct relation to the regime, while using the concepts and theories that emerge from the theory.

This can be complemented with the TM, which can be useful to recognise the internal dynamics of innovation or experiments and to understand the role of actors (including incumbent actors) influencing the governance processes (Loorbach, 2010) and so the regime. However, some issues need to be considered, as TM has been frequently used to describe transition processes as linear and smooth ventures, while most of the political criticisms contemplate that power conflicts emerge only from inside the transition arena and related activities (Hopkins & Schwanen, 2018; Lawhon, 2012), minimising external influences. MLP seems useful to represent transitions but avoids representing experiments. Additionally, institutional power is not the only variable that strength the regime and this is displayed in the Alignments and Processes of the Socio-Technical Regime model, which recognises six internal dimensions that reinforce the socio-technical system, within political power, the market and other variables.

Hence, the TM and the Socio-Technical Regime model were combined to identify dynamics, tensions and power allocated to projects and the regime, tracking cause-effects that permits transitions or the empowerment of projects. The interposition of the two frameworks can detail specific characteristics of the regime, especially how incumbents´ behaviour changed as the project become stronger or weaker while responding through modifying the regime (and sub–regimes). Thereby, it illustrates dynamics changing through time. First, it is necessary to study the project development and mechanisms used to provide robustness and create broader processes to achieve the transition, using the Transition Management framework, as illustrated in Table 4.4. Second, it is important to recognise the main characteristics of the regime, especially including characteristics and features of the different sub-regimes or dimensions, as shown in Table 4.2. Then, through detailed information of the cause-effect or process development, it can be recognised the dynamics between regime and project, especially how each sub regime was changed as a reaction for the project. The regime–project dynamics are captured for each process activity marked in the Transition Management Cycle, as it is shown in Figure 4.7

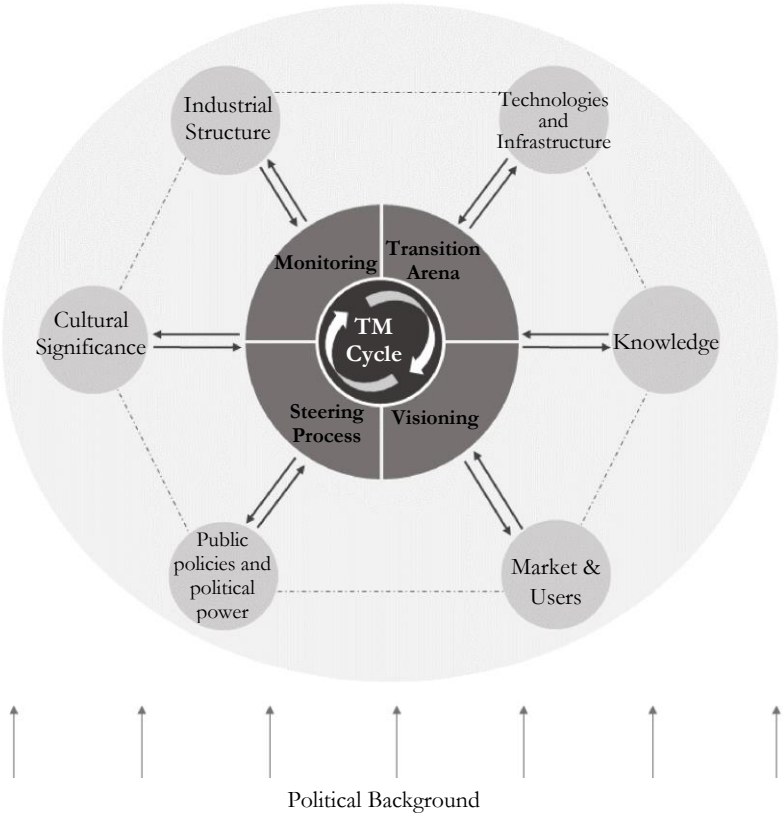

Figure 4.7 Proposed Theoretical Framework

This adapted framework allows for tracing tensions and power distributed by incumbents. Also, other considerations are needed in the framework, like contextual variables that influence transitions, a topic that has been dismissed in the MLP and the TM, which tend to relegate particularities of the global south (Lawhon & Murphy, 2011; Raven *et al.*, 2012; Wieczorek, 2017). As an example, TM tends to diminish the "*ways of including and empowering marginalised people,… and the use of local/indigenous knowledge*" (Murphy, 2015: 88 cited in van Welie & Romijn, 2018). Therefore, one of the main criticisms of this framework is the involvement of elite actors (scientist, leaders and state agents) as transition managers in the Transition Arenas while overlooking the actors that are most likely to be affected by the changes (Lawhon & Murphy, 2011). Thereby, this framework incorporates the study of *power* and political conflicts as suggested by Lawhon & Murphy (2011) while recognising the political background described in Chapter 2. Through studying power, this research recognises tensions between incumbents and upcoming niche-actors (or active actors) from the beginning while recognising that power characterises the regime (Kelly *et al.*, 2018). Also, through identifying the political background allows recognising the influence of constant competition (for power and resources) of societal actors and not only the ones that directly influence experiments, but also the broader dynamics that indirectly influence transitions. Moreover, it assists in distinguishing the political culture and governance structures or broader institutional context, as it allows for recognition that power is also shaped by material, organisational, discursive and institutional alignments that reproduce production and meanings (Turnheim & Geels, 2012).

The regime condition in the developing world is difficult to recognise (Gazull *et al.*, 2019). Wieczorek (2017) suggests that lack of knowledge or understanding of the system causes problems in identifying what needs to be changed, restricting transitions. Following Ávila-García´s (2016) claim that the Mexican water system is comprised of two structures. First, a visible arrangement that fosters the population´s wellbeing is presented as a neutral element with legal and institutional frameworks, and second, an invisible regime that maintains the existing structures and interests. It can be stipulated that the formal practices are visible and informal practices are the ones that restrict changes but are invisible. Hence, this study theorises that the Mexican water system is managed with knowledge gaps, but these gaps are maintained to keep power. Poorly designed water management strategies and the lack of clear definitions of responsibilities, allow agencies to follow practices that can be considered informal, invisible and highly politically orientated. As a result, these informal and invisible practices reinforce the lack of integral knowledge about how water is being managed, limiting the possibility for systemic change in the water governance structure. Here, Avelino & Rotmans (2011) suggest that knowledge in transition can be studied through understanding power, as it is necessary to recognise power and resources to know how power is exercised, and eventually how power can influence knowledge. Smink *et al.* (2015) suggest that power mutates and manifests during transitions. However, little has been done to understand how power (decision making and resources) influence knowledge about the regimes, especially considering that political power and institutional processes play a role in transitions.

The relationship between power and actors, including institutional and political power, can be useful to understand transitions (Avelino & Rotmans, 2011; Fuenfschilling & Binz, 2018). This displays information about *who has the power of producing a change or mobilise resources*, *who does not have power, how power change through time,* and most importantly, *who is responsible for investing in long-term sustainability matters* (Avelino & Wittmayer, 2016: 642). Here, it is vital to recognise that not everyone has the same influence in the area; something already recognised in transition research (Fuenfschilling & Binz, 2018). Still, it is important to recognise what is the political-institutional interest behind these dynamics and how they affect transitions.

4.5 Summary

Three theoretical frameworks related to the Transition Theory were introduced. The Multi-Level Perspective was presented, and the three levels of influence were recognised, focusing on the regime characteristics through the alignments and processes of the socio-technical regime model. Also, Transition Management was described highlighting the role of experiments in transitions (as they may create niche-innovations). Here, it is important to recognise that the frameworks are interrelated due to the manner that data was collected. The interviews focused on the development of two projects, so the data illustrates such project development detailing contextual influences and the pressures of the regime and incumbents. Hence, the frameworks in isolation describe specific interactions between regime-project. The description of these frameworks and the recognition of the main characteristics are helpful

to set a combined framework. This was complemented by studying power in transitions and the institutional-political influences affecting the knowledge base that affects transitions, as knowledge is used to influence decisions.

This research aims to comprehend the regime behaviour better, so some transition paths can be proposed. Dynamics between incumbent actors and innovations are gaining recognition but fails to distinguish the main characteristics of the regime in the developing world, especially when it has recognised the necessity of tailor IUWM for each specific context. Therefore, it is necessary to adapt the framework further. This is explained in chapter 5.

Chapter five

5 Mexico City through the Multi-Level Perspective lens

The chapter describes Mexico City´s regime using the Multi-level Perspective lens and reviewing the literature. The specific characteristics of the regime are recognised to adapt the theoretical framework and make it geography sensitive. This chapter introduces Mexico City in Section 5.1 and the relation of this metropolis with water. Section 5.2 describes the Mexican landscape, the existing water system or regime and the existing changes that system is phasing to incorporate an Integrated Urban Water Management approach. Section 5.3 concludes with a summary.

5.1 Mexico City

Mexico City comprises the Federal District, the political capital of the country, 59 municipalities that belong to the State of Mexico and one to the State of Hidalgo (Instituto Nacional de Estadística y Geografía, 2015). This is the result of rapid urban growth that has occurred since the 1940s, reaching a population slightly over 20 million inhabitants by 2010 (CONAPO, 2013; Instituto Nacional de Estadística y Geografía, 2015; Tortajada, 2008).

The Federal District has two main characteristic areas: the urban zone and the conservation land, as shown in Figure 5.1. The Conservation Land represents 59% of the total area of the Federal District, about of 88,442 hectares (Escamilla-Herrera & Santos-Cerguera, 2012: 10). This area receives such classification in order to restrict the urban sprawl and protect the natural assets, like the watershed of Mexico City (Lerner *et al.*, 2018; Pezzoli, 1998; Rojo, Castro & Perevochtchikova, 2018; Tellman *et al.*, 2018). This area is located in the south and southwest border, distributed in seven Federal District municipalities[6]: Álvaro Obregon, Cuajimalpa, Magdalena Contreras, Milpa Alta, Tláhuac, Tlalpan and Xochimilco (Diaz-Chavez, 2006). This Conservation Land is essential in this research because the remaining surface water has been pushed to this area, while a considerable portion of the urban water supply comes from here (Allen, Dávila & Hofmann, 2005).

The Conservation Land area is vital for the local aquifer recharge, as water infiltration occurs in the southern mountain range (Carrera-Hernández & Gaskin, 2008; Fox, 2002; Tortajada, 2006). However, this area matches with what is considered the peri-urban area or a heterogeneous mosaic of natural, rural and urban ecosystems (rural-urban gradients), which is influenced by flows and demands from rural and urban systems simultaneously (Allen *et al.*, 2005; McGregor, Simon & Thomson, 2006). In Mexico City, the peri-urban interface is comprised of middle-income residential development, indigenous villages, and mostly, of informal settlements (Aguilár & Ward, 2003). The natural character makes this area susceptible to illegal urbanisation while receiving peculiar governance. McGregor *et al.* (2006) state that this area is often ignored by both rural or urban administrations, while Allen *et al.* (2005) show that different institutions set overlaying and contradictory policies. Therefore, about 15% of the Conservation Land has been lost due to urbanisation, and the tendency shows that urban sprawl will occupy about 32% by 2020 (Caro-Borrero *et al.,* 2015d: 406).

[6] In this thesis, the world *delegación* is replaced by the municipality.

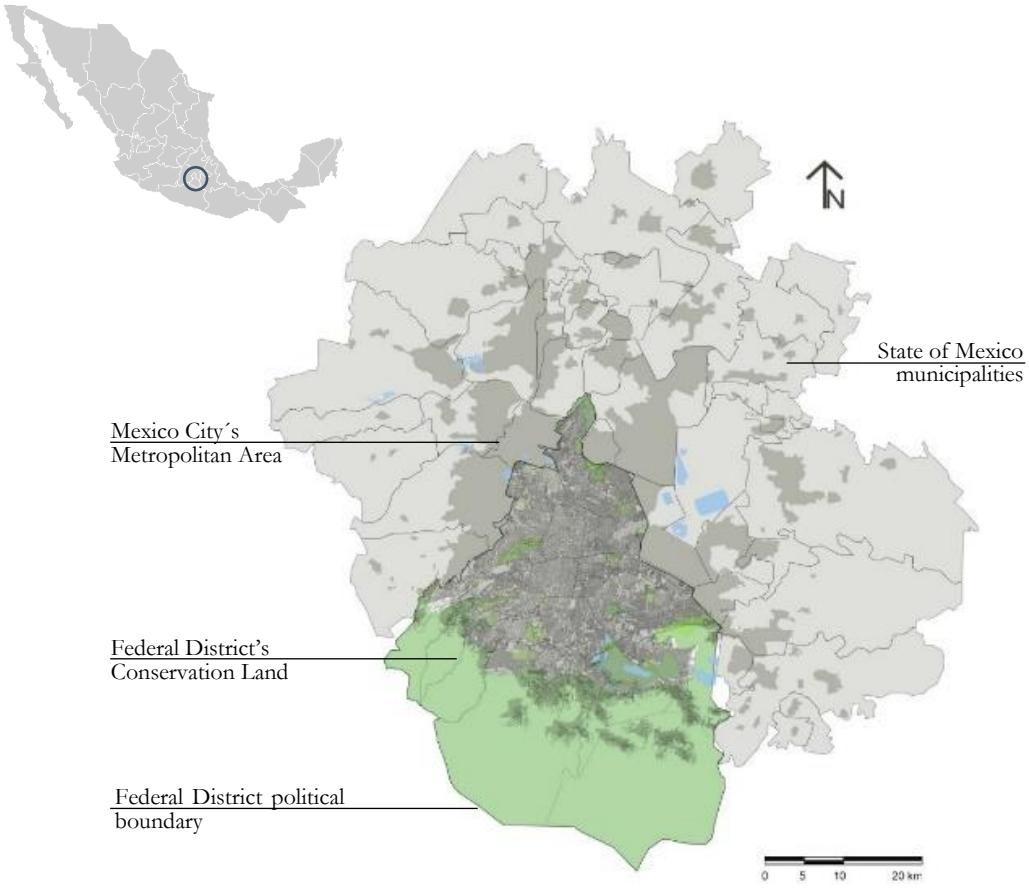

Figure 5.1 Mexico City Metropolitan Area
Based on Escamilla-Herrera & Santos-Cerguera (2012: 10) and the 2010 cadastral map.

The existing deficit of superficial water is the result of the historical decisions which, over 500 years, led to the drying up of the ancient lakes where the city was settled, and allowed the urban pattern to growth (Angeles-Serrano *et al.*, 2008; Oswald Spring, 2011; Pick & Butler, 1997; Sosa-Rodriguez, 2010), as is shown in Figure 5.2.

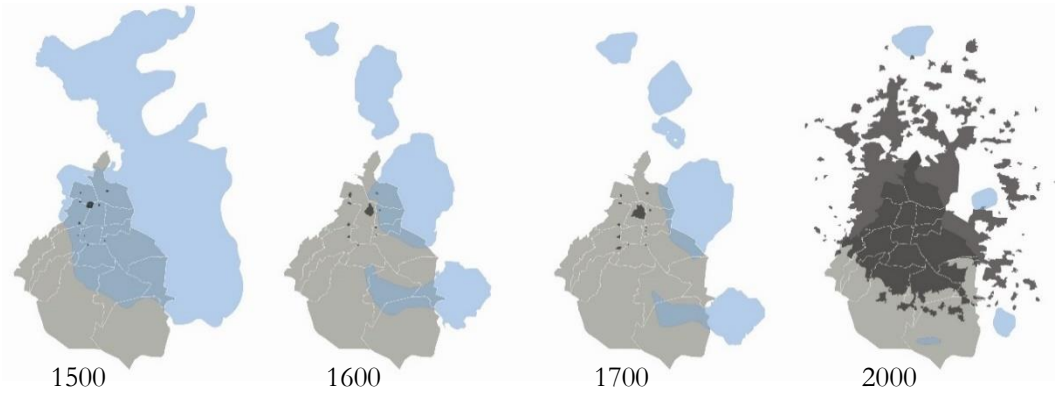

Figure 5.2 Mexico City´s lakes through the years.
The Ancient Lake (blue) diminished while the urban settlements (dark grey) grew, over the limits of the Federal District (light grey). Adapted from Álvarez (1993: 2567-IX), Garza (2000: 238) and Romero (2000, found in Monsivais-Montoliu, 2014: 39).

Mexico City: from the lakes to a dry valley

In 1325, the Aztecs established on what it is today Mexico City (Jiménez-Cisneros, 2011). At that time the area was a system of wetlands or five individual water bodies, Zumpango, Xaltocan, Texcoco, Xochimilco and Chalco, that merged forming a single lake during the rainy season (Garza, 2000). The Aztecs established a city over that lake, developing a system of dykes, channels, sluices, drains and swales that controlled the water levels (Montañana & Gálvez, 2012). The radical change started during the Spanish Colony. In 1519, the conquerors settled the capital of New Spain on the previous Aztec city, which resembled an island in the middle of the lake (Jiménez-Cisneros, 2011). They established policies and developed works to dry out the surrounding lakes (Sosa-Rodriguez, 2010). Massive infrastructures such as the Nochistongo canal and Huehuetoca tunnel were constructed to alleviate the floods that continuously affected the city (Legorreta, 2006), while seriously transforming the basin (Angeles-Serrano *et al.*, 2008; CONAGUA, 2014a; Garza, 2000; Jimenez & Birrichaga, 2012; Montañana & Gálvez, 2012; Sosa-Rodriguez, 2010).

The construction of large infrastructure to remove surface water continued after the independence in 1821 (Jimenez & Birrichaga, 2012; Legorreta, 2006), and abruptly increased during the beginning of the 20th Century, during the *Porfiriato*[7] (Romero-Lankao, 2010; Sosa-Rodriguez, 2010). The city constructed a 26 km aqueduct, which connected the metropolitan area to Xochimilco and new drainage called Great Sewage Canal or Gran Canal (Romero-Lankao, 2010). The Grand Canal helped to drain the city, contributing to accelerating the urbanisation in previously green areas, which eventually required more drainage (Legorreta, 2006), such as the second tunnel of Tequixquiac (1937-1942), the Deep Drainage System (1967-1975) and the Western Drainage System (2008-2019) (Sosa-Rodriguez, 2010; Suarez, 2019). During the beginning of the 20th century, the underground water extraction intensified, producing subsidence in the city, reaching an alarming point by 1942. Hence, freshwater was imported from other basins, but water extractions from the aquifer continued in the city (Angeles-Serrano *et al.*, 2008; Jimenez & Birrichaga, 2012). After 1950, the city sank between 35 and 46 centimetres (Sosa-Rodriguez, 2010). The population rapidly increased in the lake areas that had been dried out, producing more damage to the remaining water bodies because new urban areas and industry polluted surface and underground water (Muciño, 2001).

Hence, the physical landscape of Mexico City is one of the most altered ecosystems in the world, and just a small portion of the lake has survived in the south, Xochimilco and Tláhuac. The other visible water bodies are constructed reservoirs, like the Zumpango Lagoon in the north (Ezcurra *et al.*, 1999), as well as a series of flood regulation lagoons. See Figure 5.3.

[7] A period of governmental stability known as *Porfiriato* is related to the president Porfirio Díaz who governed the country from 1876-1911 (Speckman-Guerra, 2013).

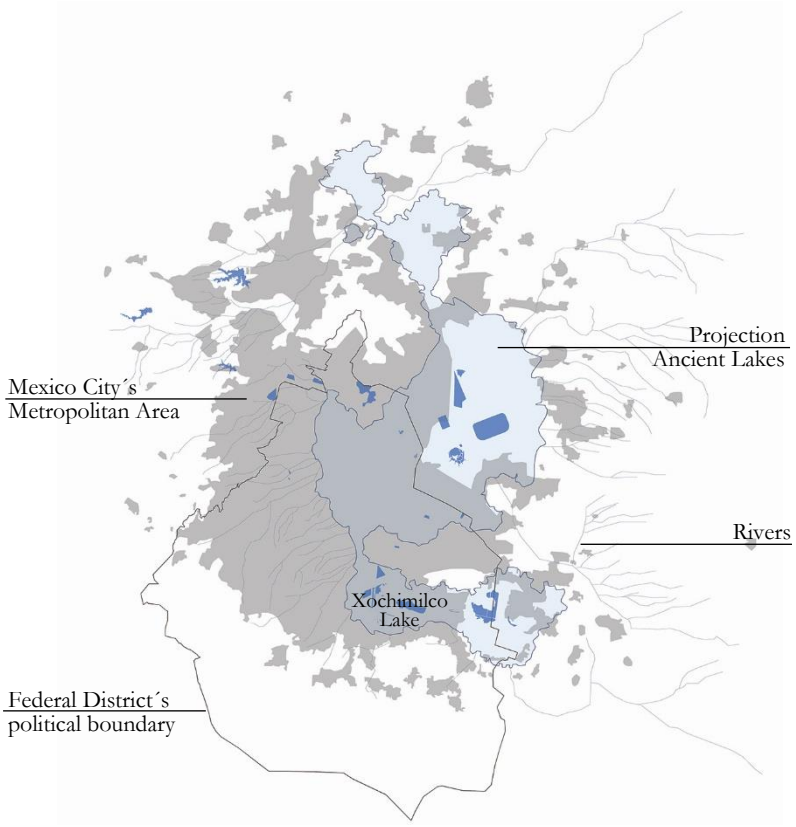

Figure 5.3 Mexico City's ancient lakes and present wetlands
The ancient lake is represented in light blue while the present water bodies are represented in the dark blue, adapted from Kalach (2012: 11).

Regulation lagoons just delay water run-offs during downpours to later dispose of it into the drainage, losing any opportunity to reuse rainwater (Ruíz-Abarca & Carmona-Jiménez, 2012). In the surrounding mountains, there are 14 perennial rivers and 31 temporal rivers that are formed in the rainy season (Montañana & Gálvez, 2012). However, most of the rivers and canals that used to feed the lakes were converted in open ditches that convey run-off, rainwater and wastewater out of the city, which eventually were culverted, comprising several kilometres of drainage and converted into roads (Castro-Reguera, 2014; Jimenez & Birrichaga, 2012; Romero-Lankao, 2010; Zambrano, 2012). The remaining rivers (high basin) are damaged by urban growth and informal settlements (Martinez & Bandala, 2015; Roldan & Sevilla, 2014).

There have been proposals to restore the original hydraulic character of the basin, being the Texcoco Lake recovery the most famous alternative to alleviate the city´s water problems. Over time several professionals have considered this alternative as highly viable and the artificial Nabor Carrillo Lake, four adjacent lakes[8] and three treatment plants were constructed at the east side of the city in 1980 (Legorreta, 2006). This artificial system produced some benefits[9], like reducing dust storms and the erosion caused by drying up the lake beds (Jimenez & Birrichaga, 2012; Legorreta, 2006). Other proposals for this lake

[8] Churubusco, Xalopango, Recreativo and Regulación Horaria Lake
[9] This system of treatment plants and wetlands treat about 50 million cubic metres of wastewater, about a third of the original proposal Furthermore, treated water cannot be used due to the high salinity of the area (Legorreta, 2006).

emerged in 1999 and 2014. However, they were stopped due to political struggles, highlighting that the lake recovery only becomes feasible when it also represents economic revenues, including energy production in the 1960s (Legorreta, 2006) or an airport in recent days (Animal-Político, 2014; Lopez-Ponce, 2019; Villegas & Malkin, 2017). Hence, there are two discourses about water management, the *business as a usual* discourse that promote the use of large infrastructure and an environmental perspective that recognise the importance of allowing surface water in this city.

5.2 Mexico City and the Multi-Level Perspective lens

The Multi-Level Perspective assists in the description of the dynamics that allow or restrict innovations. However, transitions in the developing world remain challenging to understand, especially as the global south presents different patterns than in the European context, where Transition Theory emerged (Hansen *et al.*, 2017; Ramos-Mejía *et al.*, 2018; van Welie & Romijn, 2018; Wieczorek, 2017). Thereby, this section illustrates the particularities and local variables that should be recognised to understand the dynamics affecting the innovations in this specific context while complementing the framework with other theories as recommended (Genus & Coles, 2008; Hansen *et al.*, 2017; Smith *et al.*, 2010).

Mexican Landscape

The socio-technical landscape can represent a vast number of variables, characteristics and events that traced the story of the current water management in Mexico. Therefore, this research uses Kern´s (2012) framework that syntheses landscape pressures in four variables, describing the landscape of this study, as shown in Table 5.1. However, it is essential to have in mind that the landscape is broader than is summarised.

Table 5.1 Mexican landscape pressures
based on Kern (2012)

Macro-economic trends	Macro-political developments	Socio-economic trends	Deep cultural patterns
Market liberalisation (Neo-liberalism)	Decentralisation	Deepening inequality gaps	Social Fragmentation
	Sustainability trends		Criticisms/clashes around water management

The market was liberalised in Latin America and Mexico in the 1980s-1990s due to the influence of the International Monetary Fund and World Bank, producing a series of changes in the economic, political and cultural domains in the country (Van-Lindert & Verkoren, 2010). The water management structure in Mexico embraced this economic model and suffered a series of modifications that continue until the present (Castro, 2006; Radonic, 2015).

The state-led development was transformed into market-led development, and Mexico opened up to the world market through a series of trade reforms (Van-Lindert & Verkoren, 2010). A decentralisation process, also promoted by international agencies, accompanied this model (Barkin, 2011; Godau, 1985; Van-Lindert & Verkoren, 2010). Different planning methods and development strategies were introduced, restructuring the public sector and the relationships between central, intermediate and local government. The decentralisation process transferred political power to municipal governments, which previously had been relegated behind urban populations (Van-Lindert & Verkoren, 2010). Municipalities became responsible for the local water supply and wastewater treatment (Barkin, 2011; Scott & Pablos, 2011). However, this decentralisation model was criticised as it introduced a spatial imbalance because some regions lagged economically after failing to attract investments, while the market liberalisation model did not provide the desired economic growth. On the contrary, this model increased inequality gaps (Van-Lindert & Verkoren, 2010). Eventually, this reshaped the societal, cultural patterns and increased social segregation, evident in metropolitan areas where the social structure became contested and fragmented (Van-Lindert & Verkoren, 2010). Bayón & Saraví (2013) explain that Mexico City economic inequality has segregated different populations who avoid interaction with each other. These authors suggest that criminality and violence have been translated to the city, influencing the interaction between classes. Territorial stigmas and the fear of the other have deepened the gap between citizens while denying the experience of shared public spaces, place where social solidarity, recognition and empathy between classes are created (Bayón & Saraví, 2013).

Recently, pressures from international agencies drove the Integrated Water Resource Management approaches and related policy in the Mexican legal framework. Hence, in 2004 the Mexican National Water Law was reformed to include integrated and sustainable principles (Barkin & Klooster, 2006; World Bank, 2013). Additionally, this section includes in the landscape the social criticisms and mobilisations that have emerged concerning water and natural resource conservation (Chapter 6 and 7).

Conceptualising the Mexican Water Regime and sub-regimes

The centralised and piped WSS services fulfil the concept of "*regime*" because regulations, policies, market, users, industrial structure and knowledge base, among others, accompany water supply and sanitation services (de Haan *et al.*, 2011; Smith *et al.*, 2005). Rules and practices foster quality standards and funding (service payments), while a series of heterogeneous actors (water users, consumers, workers and members of water companies, equipment suppliers and manufacturers, regulators, householders, agencies, trade and professional associations and so on) participate in operating and maintaining the task of supplying water to tabs (Smith *et al.*, 2005).

The piped water supply was established in the 1900s as the water supply regime in the first world, soon followed by the buried pipe network of sewers (Braadbaart, 2009). The infrastructure sprawl was driven to control pollution and improve human health, while it was accompanied by social and political factors that pursue the growth of social rights and the universal access to water services (Braadbaart, 2009;

Castro & Heller, 2009). This model was transferred to the developing world as the primary model to fulfil water accessibility, but its implementation was very different from its development in the first world. Castro (2006) describes that the difference lies where the WSS regime in the global south was driven by a *market model*. This regime resulted in untenable due to inequalities in the region, and the users' incapability to pay for the service. Also, the excessive cost of this system forced countries to depend on foreign grants and loans to maintain the services (Braadbaart, 2009; Castro & Heller, 2009). Water services are restricted to small sectors of the population while its accessibility (who get access to water and who allow it) is decided according to political reasons, such as buying power (Castro & Heller, 2009; Swyngedouw, 2009). Hence, the developing world structure limited the incorporation of the whole centralised WSS socio-technical regime as it is. The centralised regime and sub-regimes became a mixture of what they should be and what they need to be to cope with the global south contexts, so certain considerations must be taken when studying this regime in the developing world.

The Mexican Case

The Mexican water management system was modified to cope with the 1980s-90s liberating the market model, producing an institutional structure alteration while water users became consumers, despite that the regime does not fulfil the free-market principles (Radonic, 2015). According to Castro (2006), this is because water and sanitation are considered universalised goods and not commodities, which has pushed the water systems to be continuously expanded, over and above resource sustainability. Following the data collection and the literature review, this research proposes to incorporate the Mexican characteristics in the regime´s sub-systems defined by Smith & Raven (2012) and represented in Table 5.2.

Table 5.2 Alignments and processes of the socio-technical regime and proposed adaptations.
adapted from Smith & Raven (2012)

Theory Regime's Subsystems	**Characteristics**	**Proposed subsystem**	**Characteristic**
Industrial structure	Established structures: networks, industry platforms, user-producer interactions, routines, procedures, capabilities and resources.	**Governmental Provider Structure** (Institutional Structure)	Organisations (institutions and agencies), regulative rules, normative rules and cognitive rules.
Technologies and infrastructures	Material environment plus technical standards and infrastructural arrangements	**Technologies and infrastructures**	Formal infrastructure (hydraulic works) and informal infrastructure
Knowledgebase (scientific)	Principles and socio-cognitive processes	**Knowledgebase**	Main paradigms and behaviours Hidden actions and hidden information
Users relations and markets	Market, supply, demand, user preferences and routines.	**Financial resources and users**	Financial resources, owners and users (formal, informal and the environment)
Public policies and political power	Regulations, policy and networks with industrial structures. Political power is used to maintain the status quo.	**Public policies, political power and struggles**	Public Policy Power struggles. Who has the power?
Cultural significance and associations of the regime	General symbolisms, ideas and appreciation	**Cultural significance and associations of the regime**	Main paradigms and concepts around water management

1. *Institutional structure*

In Mexico, water agencies (a governmental provider) deliver water services, but these are neither accurately a business nor an industry. First, most of the water management in the global south is comprised of public and private industrial characteristics. This is because international and national agencies have been pushing many public service companies to operate under the market logic, even though they belong to the state (Swyngedouw, 2009). Private companies entered into the water service market but without a clear definition of responsibilities, as public agencies need to continue to be involved in the management of this resource. Furthermore, the public sector needs to continue supporting such services, making it unclear who operates and manage water services (Swyngedouw, 2009). The industrial structure is not that clear, but government agencies play a central role in the regime because they have access to resources, and therefore power. Hajer (1995, referenced in Smith *et al.*, 2005) explains that power increases in the basis of regime membership or proximity to decision making capability. Hence, the director of an institution has more power than a single user. For that reason, this concept involves organisations that do not have clear industrial structure, but who do have a central role in shaping the regime.

In Mexico, the 1980-90s market liberalisation process pushed radical changes in the institutional structure (Castro, 2006). First, an autonomous and federal agency was created in 1989, concentrating water management organisation and corresponding funding (Barkin & Klooster, 2006; Biswas *et al.*, 1997; Castro, 2006). The National Water Commission (CONAGUA) became the sole responsibility of water distribution, federal water rights collection (water use and effluent discharges), hydraulic infrastructure planning, construction, and operation (Mestre, 1997). Second, the water services passed through a decentralisation process, which put water utilities in the hands of municipalities (Garmendia-Cedillo, 2012). Nevertheless, the decentralisation process just strengthened the middle governments and not the intended municipalities (Blackman & Sisto, 2006; Van-Lindert & Verkoren, 2010).

Water is granted by CONAGUA, which supplies it to urban water providers or municipal governments, like the Mexico City Water System (SACMEX acronym in Spanish) (Martinez & Bandala, 2015). The metropolitan government, through its Water Agency (SACMEX), is responsible for managing resources and delivering the water services (supply, drainage and sanitation) related to treating and reusing the produced wastewater (Garmendia-Cedillo, 2012). Water services are a shared responsibility between SACMEX, which provides the services and the main water and drainage infrastructure lines, and the municipalities (*delegaciones*) who commonly construct and maintain the secondary lines (Lerner *et al.*, 2018). Municipalities deliver this service as part of their own municipal urban development plans, and also deliver water through pipe-trucks to informal settlements or act as intermediaries between service providers and residents (Lerner *et al.*, 2018).

The MLP has been criticised for overlooking the role of institutions and agencies, especially their role in introducing changes[10] (Geels, 2010; Levidow & Upham, 2017; Rauschmayer *et al.*, 2015; Wieczorek, 2017). Meadowcroft (2011) understands institutions as organisations while Berman, Quinn, & Paavola (2012) define institutions as collective rules, norms and culture that shape the behaviour and interaction of individuals and organisations. According to Raven (2006), three rules can be found in every sub-dimension of the regime. This study analyses these rules in this sub-regime, aiming to understand better the role of these organisations and how routines and practices become lock-in elements. Here, Scott´s (1995, found in Raven, 2006) definitions of regulative, normative and cognitive rules are used to understand the involved organisations. These internal rules are defined in Table 5.3.

Table 5.3 Regime rules/institutions
Source: SIC Scott (1995, found in Raven (2006)

	Regulative	**Normative**	**Cognitive**
Characteristics	Formal rules, laws, sanctions, incentive structures, reward and cost structures, governance systems, power systems, protocols, standards, procedures	Values, norms, role expectations, authority systems, duty, codes of conduct	Priorities, problem agendas, beliefs, bodies of knowledge (paradigms), models of reality, categories, classifications, jargon/language, search heuristics

In the case of Mexico, the regulative rules establish that CONAGUA has the maximum decision-making power because water belongs to the nation and the federation is the sole authority in this matter (Scott & Pablos, 2011). However, there are a series of gaps in water governance that translates into the limited formulation of laws and regulations (Akhmouch, 2012; Martinez & Bandala, 2015), which consequently restrict these norms and their enforcement translation to other agencies. Garcia-Frapolli *et al.* (2009) explain that despite that the existence of federal norms, local governments decide whether to implement and enforce such regulations.

> *Companies are forced to comply with...the water discharge… (and) existing norms…but it is useless. A company fulfils (the norm and treat the water) and it goes to the …(drainage) system that mixes it with black and grey water...It does not help that companies are forced to treat that water (Interview D).*

In the normative aspect, the decentralisation process has not happened yet. This is because the existing problems in the organisational model, while CONAGUA is concentrating in solving political and economic issues instead of creating an institutional strength or improve the operational system (Garmendia-Cedillo, 2012; Wilder & Romero Lankao, 2006). Also, a considerable number of agencies are involved in the water management, such as the Ministry of Agriculture due to its historical background, plus ten ministries, 13 River Basin Organisations and 26 River Basin Councils that have administrative and legal duties, besides CONAGUA, the municipalities, water agencies and private

[10] In Transition Theory, agency has been described as the capacity to produce a change in the socio-technical regime. According to Smith *et al.* (2005) agencies are groups or people with sufficient legitimate power, which commonly are politicians, incumbent institutions and actors. They require political, economic and institutional power to produce a change in the regime.

companies (Aguilar-Barajas *et al.*, 2016; Birrichaga, 2009; Escobar-Ohmstede, 2009; Garmendia-Cedillo, 2012). Most of these agencies work in a fragmented and divided manner, while the institutional arrangements (especially between municipal and federal entities) produce governance gaps, wider dispersion of responsibilities, and overlapping and contradicting practices (Lerner *et al.*, 2018; Martinez & Bandala, 2015; Tortajada, 2008). These problems are translated into the whole system, as CONAGUA does not evaluate or monitor the municipalities´ work (Akhmouch, 2012) while the Municipalities face financial problems and lack of expertise to manage water and sanitation systems (Jiménez-Cisneros & Torregrosa-Armentia, 2007). Water management is aggravated due to short municipal political periods, limiting long-term water policies, planning, pre-evaluation, consultation, several stages of implementation and post-evaluation (Martinez & Bandala, 2015).

Cognitive rules establish believes and paradigms. Some researchers point out that water management continues responding to privatisation and free-market pressures. The system continues to prioritise water supply through construction works and increasing the offer, but not to all the population (Barkin, 2011). Here, it is important to see how these three rules influence each other and shape the institutions and organisations, especially when dealing with transitions.

2. *Technologies and infrastructures*

Mexico City has an *"advantageous"* position concerning water services. Banister & Widdifield (2014) relate how at the beginning of the 20th century (Porfiriato), the city's government decision-making involved a close relationship with the president who placed the capital city as a federal priority. The federation dealt with city problems through hydro-technological constructions (Banister & Widdifield, 2014). However, such privilege was translated into a high dependency on a large infrastructure to continue providing services but over the expenses of natural resources.

In Mexico City, 68% of the freshwater comes from local underground aquifers and rivers, and about 32% comes from external resources (Romero-Lankao, 2010). The overexploitation of internal and external water sources has created a series of problems. Martinez & Bandala (2015: 112) explain that the local underground aquifer presents an overdraft of 27m^3/sec, as more water is extracted than recharged into the aquifer. This had caused severe subsidence in the city, increasing the urban vulnerability as it alters the water network and the sewage system while producing some cracks in the underground pipes (Sosa-Rodriguez, 2010). About 40% of the existing supplied water is lost (25,000 litres per second) because of leaks in the supply network (Adler, 2011: 100). Also, wastewater flood risk grows because the city centre is located seven metres below one of the main drainage channels (Great Canal) (Tortajada, 2006).

Mexico City depends on the Lerma and the Cutzamala Systems as external sources. The first one connects the city with a river located 62 kilometres north-west from the metropolis (Tortajada, 2006). The population and the environment nearby the Lerma System have been severely altered by the loss of

water for productive agricultural land (Delgado-Ramos, 2015). The Cutzamala System transports water about 126 km while pumping it over 1,200 m high to reach a closed hydrological basin that is over 2,240 metres above sea level or Mexico City (Ezcurra *et al.*, 1999; Tellman *et al.*, 2018; Tortajada, 2006; Tortajada & Castelán, 2003). The extraction of water in the Cutzamala area also represent constraints for the local people (Tortajada, 2006). Current proposals are aiming to expand the water system towards further water resources, like the Temascaltepec River in the State of Mexico, which was dismissed due to social protests of neighbouring communities (Delgado-Ramos, 2015; Fuentes & Sosa, 2015).

The drainage system gradually expanded to control floods (Izazola, 2001), reaching further areas as the Tula River in the Mezquital Valley in Hidalgo State (Ezcurra *et al.*, 1999). Tortajada (2006) explains that subsidence in the city caused the Great Swage Canal (Gran Canal) has lost its inclination in the 1950s. Hence, it became necessary to start pumping water to make the drainage useful as it used to work by gravity, increasing the operation cost (Tortajada, 2006). The government introduced in 1975 the Deep Tunnel Sewerage System (Drenaje Profundo), which was constructed 240 metres deep to avoid being affected by subsidence. However, in the present, the Deep Tunnel is damaged and requires eleven pumping stations to remove 48m^3/s of wastewater (Izazola, 2001; Romero-Lankao, 2010; Sosa-Rodriguez, 2010; Tortajada, 2006). Then, the wastewater extraction deficit during the rainy season was compensated with the Western Drainage System (Tunel Emisor Oriente-TEO) to discharge 150 m^3/s of wastewater (Jimenez & Birrichaga, 2012; Notimex, 2013).

Importing freshwater and exporting wastewater has become extremely expensive, representing a large portion of the national budget due to the high consumption of energy to pump water in and out of the urban basin (CONAGUA, 2014a; Ezcurra *et al.*, 1999; Jimenez & Birrichaga, 2012; Notimex, 2013; Tortajada, 2006; Tortajada & Castelán, 2003). Moreover, the existing infrastructure is fragile and tends to fail (Castro-Reguera, 2014). The city continues to suffer from extreme flooding after a single storm[11] (Ruiz-Palacios, 2015) or water scarcity due to the absence of rain in the Cutzamala System (El Informador, 2009). Likewise, the system and services are affected when the infrastructure requires maintenance (Al Momento, 2013; Navarrete, 2015), or simply because the system fails:

> *... (to remove water through La Compañía River) water must be pumped eight metres high...and then it is like 20 kilometres to get it out of the Valley of Mexico. Then, there are many pumps…that are prone to failure. First… heavy rains have caused floods in the pumps entrances… (preventing) the access to supply diesel and fuel… then pumps stop pumping, and water cannot be removed (Interview C).*

The amount of treated water produced and used in the city is barely anything to the wastewater produced. In 2003, treated water represented just 9% of the total amount of the city's wastewater (Tortajada & Castelán, 2003), reaching 11% in 2012 (Jimenez & Birrichaga, 2012). Most of the treated water is used to irrigate the city's green areas, to recharge the artificial lakes in Chapultepec and Aragon parks, as the southern wetlands (Ezcurra *et al.*, 1999; Jimenez & Birrichaga, 2012).

[11] Some storms in May and June 2017 generated more than 75m^3/s causing over one metre high floods, because the system can only deal with up to 30m^3/s of rain (Sarmiento, 2017).

Tellman *et al.* (2018) state that Mexico City´s existing infrastructure has created a lock-in position, limiting the implementation of alternatives to existing water management. This is because the regime needs to continue to maintain and build new infrastructure, as the consequences of stopping these activities will be devastating. The *new* Atotonilco Treatment Plant[12] is an example of this lock-in situation. First, this plant involves the introduction of a large infrastructure at the end of the already constructed system without proposing any change in water management. Second, this plant was constructed to treat 70% of the wastewater produced in Mexico City, which is discharged into the Mezquital Valley, Hidalgo State (Jimenez & Birrichaga, 2012; Martinez & Bandala, 2015; Peña-Garcia, 2012), but it also demands that the city continues as usual, producing wastewater to maintain the operation of such plant (Interview C).

Another important topic is the informal infrastructure or the existing services outside the official institutions. This is because there is a gap that gives way to a series of behaviours and routines to create services for the urban population whose water services are denied. In Mexico City, informal settlements lack water and sanitation services, forcing them to create their informal infrastructure services (Canabal-Cristiani & Narchi, 2014), such as disposing of wastewater into the water bodies. Here, informal infrastructure exists and influences the whole water system while altering water resources. However, this fact is rarely considered as part of the water system, at least in the Mexican literature.

As a summary, it can be stated that it is necessary to understand the existing technology because it causes lock-in, as well as the rationality or the know-how that pushes to continue using such technology while recognising the informal infrastructure that is somehow allowed by the regime structure.

3. *Knowledgebase*

Two contradiction logics support the regime: the technical logic based on engineering-scientific knowledge and political logic (Castro, 2006). The technical logic reinforces *business as usual* practices, as incumbent actors do not see a problem on the system but just small failures that can be solved with the introduction of similar technology (Interviewee A). The political logic influences decision making based on buying political favours and gaining power (Castro, 2006). However, these two rationalities have pushed the decision-making to focus on temporal solutions (water supply) without paying attention to the whole system, dismissing several important issues like the factors that make the city vulnerable. This is evident as currently water is being extracted from deeper aquifers (Ramos & Sosa, 2018), despite the subsidence issues that exist in the city.

There has been a tendency to manage the system without accurate information and a comprehensive plan of action in the water sector (Barkin, 2011; Barkin & Klooster, 2006). Martinez & Bandala (2015) explain that information is not equally shared across stakeholders which limit the standardisation of

[12] This plant was formalised in 2007 as part of the Hydro-Sustainable Programme of the Valley of Mexico basin (PSHCVM) within the collaboration of the federal, Federal District and State of Mexico governments (Martinez & Bandala, 2015; SEMARNAT, 2011). The construction was announced in 2009 and terminated in 2017 (Acciona-Staff, 2018).

procedures. The inadequate information sharing can relate to *information asymmetries*, which according to Kumar (2009), is a common characteristic of water supply systems in developing countries. Gaudet & Lasserre (2015: 292) define that "*asymmetric information occurs when one of the parties involved in a strategic relationship has private information about some important elements relevant to the relationship"*. This term has been used to illustrate inadequate distribution and understanding of information (Akerlof, 1979; Auronen, 2003; Löfgren, Persson & Weibull, 2002), deficiencies in natural resource management (Ferraro, 2008), democratising processes in water management (Pfaff *et al*., 2013) and how water agencies control the market and decision making (Cerin, 2006; Mann & Warner, 2019).

This term is commonly used to describe water transaction problems because the water owner or principal (the state) usually do not control the water, because water management is delegated to an agent (water agencies). Thus, the principal tends to ignore how much water has been extracted or the real cost of managing it, while the agent has private information about the system (Gaudet & Lasserre, 2015; Tsur, 2000). The principal introduces certain practices in the agent through regulations, such as sustainable principles. However, regulations and their outcomes can be limited due to the lack of information about the agent and its practices. In return, the agent can manipulate the regulation to obtain own benefit (i.e. excessive profits and internal permissiveness as described by Jouravlev, 2001). The asymmetry of information tends to be a problem, especially in countries that have fewer monitoring and regulation capabilities (Jouravlev, 2001; Kumar, 2009). Additionally, Gaudet & Lasserre (2015) contemplate that information about natural resources is in constant flux due to the dynamism of the resources, that vary over time (i.e. rainy or dry seasons) and due to resource exploitation dynamics (i.e. water aquifer exploitation).

Information asymmetry illustrates that the information problem is also related to its distribution, which mainly responds to economic and political interests (Cerin, 2006; Ferraro, 2008; Gaudet & Lasserre, 2015). Jouravlev (2001) describes two main variables that comprise the asymmetry of information: (1) *hidden actions* are internal variables that the principal cannot accurately observe and that the agent can modify in a discretional manner; and (2) *hidden information* refers to the external variables that cannot be intervened, but the agent has a broader knowledge about them than the principal. This research recognises that these variables may be invisible due to the characteristics of the regime, as Pierce (2012) describes that water management became too obscure after 2000, when a new political party ruled Mexico City. Still, it can be useful to recognise how information is managed and is it used as a power tool.

4. *Financial resources and users*

As a consequence of the market liberalisation process, water became a good and CONAGUA officially started to distribute water rights concession titles to all the water users in the country in 1992, accompanied with the rights legislation (Water Right Federal Law issued in 1986 and Wastewater discharges fees in 1991, Radonic, 2015; Terregrosa & Jimenez-Cisneros, 2009; Interview F). However,

more water was assigned than the total amount of water available due to no reliable information about water extractions and wastewater discharges, as in the case of Mexico City that has many supply sources (wells) and discharges. Additionally, users hide information about their water supply and requested more concession rights, while CONAGUA did not consider the water variabilities related to the dry season compromising more water than they should (Interview E and F).

Despite the promotion of water as a commodity good (Castro, 2006; Castro & Heller, 2009), water management is far from becoming profitable in the developing world as related services have proved not to be an *"attractive business"* in the global south (Swyngedouw, 2009). This is the case of Mexico, where the construction, administration, distribution and conservation of hydraulic resources were transferred to social and private institutions (Jiménez-Cisneros & Torregrosa-Armentia, 2007). In Mexico City, some water reforms were introduced in 1989, after the authorities realised that supply strategies were no longer feasible, water was scarce and polluted, and the provided services did not obtain enough revenues to cover the service costs. Wilder & Romero Lankao (2006) explain that this led to the creation of SACMEX, as the primary organisation responsible for water service management in the city, and an increase in water fees and improvements to the water infrastructure. Water services were privatised from November 1992 to March 1993, when four companies became private administrators of water systems in the Federal District. Wilder & Romero Lankao (2006) explains that the supply system improved, but the system did not become equal across the city, financial self-sufficient nor reduce the historical deficit, and the system´s debt continued growing. This is because private companies are not interested in investing in replacing or expanding the infrastructure, despite there not being a monitoring system to evaluate private companies' performance (Wilder & Romero Lankao, 2006). Hence, this privatised model faced a series of barriers, such as the poor division of responsibilities between the government agencies and the companies and the difficulties related to revenues collection as there is not a *"consumer-pays"* principle in this city. Mexico City water consumers do not receive incentives or punishments if they pay or not for the services (Wilder & Romero Lankao, 2006). Consequently, the city´s water system is barely maintained while the required investment already exceeds the long-term budget of the existing plans (Martinez & Bandala, 2015).

Therefore, there is a market, but it does not provide the economic strength to be considered as such. Terregrosa & Jimenez-Cisneros (2009) explain that water services collected fees do not remain in the water sector, due to the weak institutional structure and the political use of the water fees (buying votes or political favours). The water system of Mexico City lacks financial resources and relies on subsidies. These resources are maintained by the state for the maintenance of urban water services, while SACMEX has a series of mechanisms to access economic resources. However, these mechanisms (formal and informal) also create lock-in structures, as water agencies heavily rely on maintaining the capital flowing.

> *….In the fees, water treatment is charged but … not executed… (Industries) are charged… for discharge every cubic meter... A big part of the problem is that the Water System prefers the companies' money…Grupo Modelo wanted to do a project and irrigate the entire Chapultepec forest... However, they*

rather do not to give … permission as it represented 150 million pesos per year that this company would pay for the discharge of that water (Interview D).

Citizens became users in this model, but it is important to emphasise that three types of citizens play a fundamental role: (1) regular users that pay fees and are part of the existing regime, (2) informal residents whose relation with the regime is blurry, and (3) owners. The owners do not own the water but own the land where water emerges, so they have a specific role in water management. Regular water users are not equal in the city. Jimenez & Birrichaga (2012) describe that water consumption is extremely high, as 3.2 million people use 300 litres per capita per day, while the lower socio-economic population consume 20 litres per capita per day (Canabal-Cristiani & Narchi, 2014: 94). This is because water policies focus on maintaining the system and preserving the *status quo* of some sectors, but making the system unfit for the city's real necessities (Bojórquez-Tapia *et al.*, 2011). Even though 97.7% of the population in the Federal District have access to water (Pierce, 2012), the reality is that this number hides the difference in service quality. Pierce (2012) describes that the real number of in-home piped connection in 2010 was 86.5%. Hence, there are a considerable number of people that receive water for a few hours per day ("Centro Virtual de Informacion del Agua," 2005; Swyngedouw, 2004) or buy water from trucks, which is 500% more expensive than centralised piped water (Tortajada & Castelán, 2003). Part of the population that receive water from trucks is considered informal population because they are not connected to the network. This population plays a fundamental part in political water control, as they eventually become regular settlements in the interchange of political power (Fernández-Eguiarte *et al.*, 2002).

A considerable part of water comes from Mexico City Conservation Land, but every three hectares of land, about de 27,000 hectares, belongs to rural towns or indigenous settlements (del Roble Pensado, 2001: 43; Escamilla-Herrera & Santos-Cerguera, 2012). These settlements are also known as *ejido* or communal land[13]. This type of communal land tenure was created as part of the 1920s agrarian reform that returned the land that originally belonged to the indigenous population but was lost to create haciendas (del Roble Pensado, 2001; Pezzoli, 1998). Dealing with *ejido*s or communal landowners can be complicated due to the tangled relationship between these groups and Mexico City government, especially as the government tend to influence the local political power structure while reinforcing corporatists conduct (del Roble Pensado, 2001). These communal groups are in this sub-regime as they own the land from where water springs are located. Their political structure makes them an entity within the water management structure, especially as they feel that they also own the water (RM15; RM18; PUX08; PUX09).

Also, the environment has been considered a water user since 2004 (Wilder, 2010). This change stipulates that a certain amount of water (ecological base-flow) should remain in superficial water features for environmental purposes (Diaz-Caravantes & Scott, 2010; SAGARPA, 2012). However, this new user was challenging to introduce because of the traditional perception of water management in Mexico,

[13]Robles-Berlanga (2000) describes that the land was returned as communal land to guarantee equity to the original or indigenous towns.

which prioritises the productive use of water, like domestic use, industry or agriculture (Cotler *et al.*, 2007). This new user can be considered problematic in an area where water is scarce, and not all the citizens have access to it. Moreover, this new user is not respected in Mexico City, as water bodies continue to be highly altered and polluted (see case-studies).

5. *Public policies, political power and struggles*

Water is a national good that can only be used through federal authorisation (Scott & Pablos, 2011). This is established in the 27th article and fifth paragraph of the Constitution while the National Water Law dictates water management regulations and rules (Mestre, 1997). Mexican water policy is the responsibility of the Ministry of the Environment (SEMARNAT), divided into two decentralised bodies: the National Water Commission (CONAGUA) and the Attorney for Environmental Protection (PROFEPA), plus the Ministry of Health (SS), as stated by Akhmouch (2012).

This National Water Law was first created in 1972 to regulate water use, resource exploitation, and to unify several legal frameworks (prioritising domestic and urban uses over agriculture and industry) (Birrichaga, 2009). Consequently, this law has been modified to modernise water management. In 1992, some reforms were introduced to include market, decentralisation and privatisation principles, while reinforcing the responsibilities of the municipal water agencies (Radonic, 2015; Scott & Pablos, 2011; Wilder & Romero Lankao, 2006). This was possible through the introduction of private usufruct rights and the reform of the 27th constitutional article (Mestre, 1997). The 2004 reforms accelerated the decentralisation processes while promoting watershed water management and sustainable principles, such as IUWM approaches (Jiménez-Cisneros & Torregrosa-Armentia, 2007). However, the implementation of new regulations or sustainable projects tends to be prevented by a highly inefficient and complex legal framework, comprising multiple layers of legal protocols and no consistent criteria, which also obstructed CONAGUA´s regulatory functions (World Bank, 2013). This is because the existing policy has been formulated trying to catch up with the water supply and urban population growth rather than propose a guiding strategy (Martinez & Bandala, 2015; Sosa-Rodriguez, 2010).

Power in water management in Mexico City is already a political matter, as it has been managed to favour some sectors or gain political power while shaping conflicts between competing users, political entities and agencies (Castro, 2006; De-Alba, 2007). This has created a series of conflicts and social protest, which according to Castro (2006) aggravated after the 1992 water law reforms. This is because the new water management model and its unplanned implementation raised the existing inequalities in water distribution. Power struggles of water in Mexico City has been highly studied (Canabal-Cristiani & Narchi, 2014; Castro, Kloster & Torregrosa, 2004; Castro, 2006), especially using the Urban Political Ecology (Swyngedouw, 2004; Vitz, 2018). Hence, this theory can explain many issues of Mexico City as it identifies that power (or capital distribution) shape most of the urban interactions and defines the urban water system as a hybrid (that is comprised of socio-natural structures, as described by Swyngedouw, 2004). This theory states that power controls the use of natural resources, allocating costs

and benefits of such resources unevenly across the city and between the different classification of people (Angelo & Wachsmuth, 2014; Rodríguez-Labajos & Martínez-Alier, 2015). Thus, power plays a central role in maintaining and reinforcing classes and *status quo*, while inhibiting changes in water management. Thereby, this theory recommends recognising *who has the power* (Ernstson & Swyngedouw, 2019; Heynen, 2013; Lawhon & Murphy, 2011), which can be complemented by Avelino & Rotmans (2011) idea of tracing power in transitions.

6. *Cultural significance and associations of the regime*

Mexico´s economic growth has been an imperative in the history of water management, which previously encouraged heavy agriculture and hydroelectric infrastructure (Barkin & King, 1970), an idea that was reinforced after the introduction of the market liberalisation model. Therefore, the central concept around water management is the utilitarian purpose of it. Also, the idea of water as a universal right exists in a parallel and contradictory paradigm to the economic one (Castro, 2006). These two paradigms complicate the water management while relegating the management of natural resources (or conservation) under services supply goals. Hence, environmental concerns are relegated underneath water management plans, especially under the service provision (Diaz-Caravantes & Scott, 2010).

Synthesis

The introduction of the market liberalisation discourse in Mexico created subsequent changes in water management while legitimising the market goals. Through this process, stakeholders, economic resources, infrastructure and organisations were aligned to support this model. However, not all the sub-regimes were aligned to the same goals because some voids in the regime complicate the full implementation of this model, such as the precise definition of responsibilities, the lack of economic independence of the water agencies and municipalities, and an uneven distribution of power.

The previous analysis of the literature helps to understand the existing regime behaviour and gives a glimpse of the regime's resistance to change water management in Mexico City. This section just illustrates the existing Mexican regime as the following section comments about the implications of translating the Integrated Urban Water Management approach (IUWM) as the socio-technical configuration to replace or complement the existing water management regime in the Mexican context. As state before, the Mexican policy was reformed to include this approach in water management, recognising that there is a global niche creating some pressures, and so, the case studies were based on an IUWM approach, incorporating supply and drainage programmes, besides institutional changes. However, this approach in the Mexican setting requires a series of changes in the regime while demanding some links or collaborations between organisations that can be considered from different systems and regimes. Hence, the considerations of translating the IUWM in Mexico are studied in the following section.

Implications and assumptions of translating the Integrated Urban Water Management in Mexico City

Mexico City´s Water System is facing pressures from the landscape and some niches. Thereby, it is possible to find local proposals like rainwater harvesting and water savings proposals (Adler, 2011; O´Hanlon, 2009), as the plans that accompanied the interest in returning the basin character lacustrine system and rehabilitating Texcoco Lake (Section 5.1). However, in this case, there is not a transition as such, but a regime transformation. Berkhout *et al.* (2010) describe that there are three circumstances when studying transformations in the regime: (1) there is not yet a niche, (2) the regime response to pressures from the landscape level or outsider social groups, and (3) the socio-technical regime is emerging. Circumstance 1 and 2 were evident for the two studied projects, and circumstance 3 occurs if considering that environmental conservation is a socio-technical system. The term of system defined by de Haan *et al.* (2011) is used, which establishes that a system involves all the related water services or sub-systems that fulfil specific needs (i.e. supply, sewage or drainage systems), and the regime is the most powerful sub-system (de Haan *et al.*, 2011; Grin *et al.*, 2010). The environmental conservation can be considered a system as it involves human interventions (mobilisation of human and technical resources, Berkhout *et al.*, 2010) in restoring the natural structures, aiming to provide services for the population, such as environmental services (Kandulu *et al.*, 2014; Schäffler & Swilling, 2013). Here, this system is already established, but facing a transformation within the water system to allocate a *"new"* regime that interlaces water and environmental systems.

Conceptualising the IUWM as a socio-technical system

Brown *et al.* (2009) recognise six main paradigms in the history of water management. Figure 5.4 shows these paradigms allocating at the left the centralised WSS services or the piped water supply, sewerage and drainage systems that emerged responding to several drivers, such as water security, public health and flood protection. On the right hand, the three aspirational paradigms are presented, which have not been achieved yet despite some drivers pushing towards environmental protection, natural resources conservation, and equity and resilience through achieving Water Sensitive Cities. De Haan *et al.* (2015) state that the implementation of any of the three aspirational paradigms (waterways city, water cycle city and water sensitive city) constitute a transition because their infrastructure and institutional solutions do not align with the established regime. Additionally, these paradigms emerged through dialogues aligning expectations and visions such as sustainability, resilience, prosperity, adaptive capacity, integration and interdisciplinary approaches, among others (de Haan *et al.*, 2015). Brown (2012) describes that the current movement, in the developed world, is towards waterways cities because the three first paradigms (water supply city, sewer city and drained city) have been achieved at least in most parts of these countries.

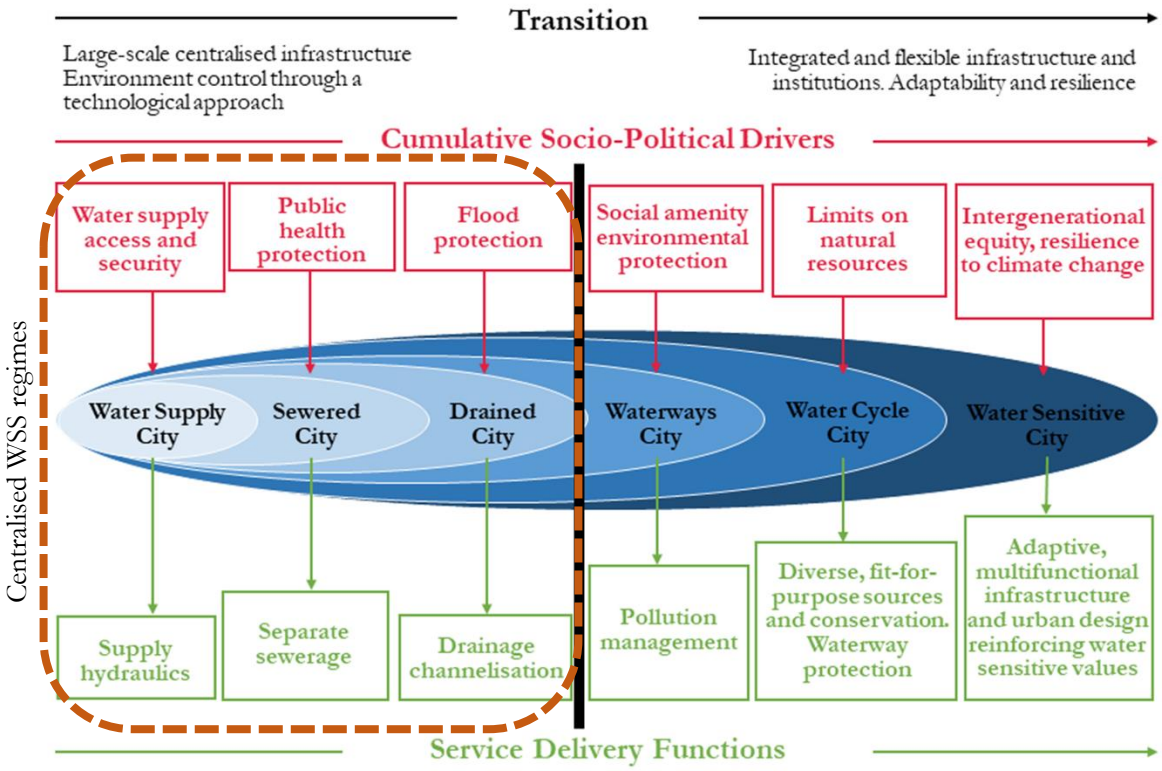

Figure 5.4 Transitions in Urban Water Management
Source: Brown *et al.* (2009; found in de Haan *et al.* (2015)

This research uses the concept of Integrated Urban Water Management that is similar to the Water Sensitive City. IUWM refers to a series of techniques and concepts that manage urban water as part of the whole natural water cycle, promoting water security through diversification of local sources and fit for purpose practices, mitigating the urban impact on the hydrological environment (Fletcher *et al.*, 2014; Grant, 2016; Lundy *et al.*, 2013; Marlow *et al.*, 2013; Wiering & Immink, 2006). This can be achieved through alternative solutions, distributed technological measures, policy initiatives and public awareness (de Haan *et al.*, 2015; Fletcher *et al.*, 2014; Raja Segaran *et al.*, 2014), fostering a flexible institutional context allowing an adaptive and continually evolving water-human relation (Wong & Brown, 2009).

IUWM secures water supply through the maintenance of ecological health of water elements (de Haan *et al.*, 2015). Therefore, the importance of designing spaces for water and re-wilding the cities, merging landscape design and a series of benefits (Blau *et al.*, 2018; Gandy, 2014; van-Herk *et al.*, 2013; Wiering & Immink, 2006). Thus, IUWM deals with several problems while simultaneously achieves several goals like resilience, urban sustainability and other benefits related to the ecosystem services, such as flood risk reduction, controlling soil erosion and enhancing natural floodplains, among others (Chanan *et al.*, 2010; Farrelly & Brown, 2013; Ferguson *et al.*, 2013; Fletcher *et al.*, 2014; Jensen & Nair, 2019; Young & Esau, 2013).

IUWM emerged to deal with water security threats and to introduce a balance between human and environmental needs, safeguarding essential ecosystem services and biodiversity (Clark & Hakim, 2014).

These approaches have gained recognition since the late 1960s (Mitchell, 2006) with the increasing global concerns about climate change and water services distribution inequality (Gabe, Trowsdale & Vale, 2009). Mitchell (2006, based on Niemczynowicz, 1999) summarised the IUWM principles as follows:

- Contemplate the whole water cycle, recognising it as an integrated system of natural and human-made elements, as surface and subsurface components
- Consider equally anthropogenic and ecological requirements for water
- Recognise local context, as the environmental, social, cultural and economic viewpoints
- Take account of all stakeholders in the decision-making procedures
- Strive for sustainability and a balance between environmental, social, and economic needs in the short, medium, and long-term

Mitchell (2006) principles, along with Keath and Brown´s (2009, referenced in Brown, 2012: 31) main characteristics for an *"aspirational"* paradigm in water management can be interpolated to the socio-technical regime model (Smith & Raven, 2012) to describe the IUWM as a similar system. This is summarised in Table 5.4.

Table 5.4 Alignments and processes of the socio-technical systems: regime and IUWM
Adapted from Smith & Raven (2012) and Keath and Brown (2009, referenced in Brown, 2012).

Concept	Centralised WSS	Integrated Urban Water Management
Description	Water supply, drainage and sewerage services, plus flood control	Various and simultaneous purposes (within the traditional services), waterway health, recreation, amenity, energy, etc.
Industrial framework	Water agencies and other offices that provide these services	Water agencies and environmental institutions, among others
Technology and infrastructure	Centralised, linear infrastructure Technological/economic base	Natural and human-made elements, centralise and decentralised infrastructure. Flexible solutions at multiple scales
Knowledgebase	Technical and economic disciplines	Interdisciplinary and multi-stakeholder learning across different domains (social, technical, economic, etc.)
Financial Resources	Market approach	Fiscal measures and investments from governments
Users	Clients	People and the environment
Public policies and power	Political power is used to maintain the existing status quo.	
Decision making capability (Governance)	Water is managed on behalf of communities by the government	Co-management between government, private companies and communities (all the stakeholders are involved in the decision making and policymaking)
Cultural significance and associations of the system	Water is a good (or a community right)	Sustainability is the primary goal, reaching environmental, social, and economic balance.

Table 5.4 displays some matters when interpolating the theory related to the regime and the IUWM. Governance can be considered as a new sub-system that the IUWM proposed while including community participation in the water management decisions. Whilst, the characteristics of the IUWM

that involve public policies and political power seem empty. IUWM is commonly a *"nirvana concept"* or a vague notion that minimises the political background, but certain groups can easily use it to legitimise interests, as stated by Furlong *et al.* (2016b). Also, on reviewing the literature, it is recognised that policy and regulations play a fundamental role in implementing IUWM approaches. Ross (2018) strongly supports the introduction of a policy to provide direction in the path of introducing IUWM, within the corresponding legislation to create the obligation of adopting it. However, what should be the appropriate legislation remain unknown, as IUWM can create unpredictable outcomes when applied into specific environments (Furlong *et al.*, 2016b). Moreover, exporting legislation implemented elsewhere has proven to be an inadequate solution due to local constraints (White, 2017). Hence, the importance of recognising the local characteristics of Mexico City.

Translating the IUWM to Mexico City

This section aims to understand better the sub-dimensions of this socio-technical system and the implications of translating into Mexico. The main characteristics of the IUWM approaches are described, recognising that some advances have been achieved in Mexico City towards adopting IUWM, but some restrictions remain.

1. *Institutional Structure*

IUWM encourages the coordination of urban water services, institutional functions, planning instruments and the management of water, land and other natural resources to maximise the efficient and sustainable administration of water resources (Grit *et al.*, 2015; Petry & Dombrowsky, 2015). Hence IUWM relies on the coordination of at least two domains: water (natural) resources and water services management, which have been traditionally managed separately (Seppala & Katk, 2009). However, in Mexico, when water and environmental concerns intersect, the law becomes quite complex and inefficient. The existing laws establish that CONAGUA is responsible for enhancing and preserving basins, as well as to restore the hydrological equilibrium of all waters, as stated under the Mexican National Water Law (Diaz-Caravantes & Scott, 2010). However, water agencies generally assume no responsibility for environmental issues, leaving a real gap in such matters (Barkin & Klooster, 2006).

In 1994, the Ministry of the Environment and Natural Resources (SEMARNAT) comprised an independent organisation to manage the environment and natural resources (Escobar-Delgadillo, 2007). This agency comprised three sub-ministries for planning, natural resources and fisheries, and five institutions, which are CONAGUA, Mexican Institute of Water Technology or IMTA, National Institute of Ecology (INE), Environmental Protection Federal Attorney (PROFEPA) and the National Institute of Fisheries[14] (Ezcurra *et al.*, 1999). Moreover, water conservation is the responsibility of several agencies, including the Environment and Agriculture Ministry in rural areas and local governments in urban areas

[14] In 2000, this ministry lost its jurisdiction over fisheries and was renamed SEMARNAT (Blackman & Sisto, 2006).

(Barkin & Klooster, 2006). In the Federal District, there are a considerable number of agencies interfering in the environmental domain. First, the agencies that intervene in the urban planning and urban growth, such as the Ministry of Urban Development and Housing Ministry (SEDUVI), the Mexico City Environmental Ministry (SEDEMA), the Regularisation and Land Tenure Commission (CORETT) and the National Agrarian Registry or RAN can be considered (Lerner *et al.*, 2018). Second, the environmental law grants responsibilities to the municipal presidents, as well to the Environmental and Land Planning Attorney (PAOT) and other supporting agencies (Ruiz-Gutierrez, 2012).

Environmental institutions faced the decentralisation process in the 1990s, and decision-making on environmental matters was translated to state governments that produced their environmental laws. This event imposed financial constraints to the Federal Ministry of the Environment while reduced the responsibilities of some federal agencies, like the National Institute of Ecology (Ezcurra *et al.*, 1999), making evident the lack of municipal resources to deal with environmental issues (Blackman & Sisto, 2006; Van-Lindert & Verkoren, 2010).

Concerning the legislative rules, there are barely improvements in the environmental domain because the law and regulations are not applied (Saldaña-Monroy & Monroy-Matínez, 2012). Whilst, literature criticises how there is an over-regulation that encourages fragmented and inconsistent management of natural resources. There is no common strategy between the existing agencies (Ruiz-Gutierrez, 2012; Tortajada, 2006), while the fragmented governance restricts the implementation of sustainable approaches (Akhmouch, 2012; Connelly, 2003; Escamilla-Herrera & Santos-Cerguera, 2012). Environmental resource management is complemented with plans, programmes and projects, which comprise a series of objectives and the related actions to deal with environmental problems (Rojo *et al.*, 2018; Saldaña-Monroy & Monroy-Matínez, 2012). However, the fragmentation conveys high costs and limited results due to the multiplicity of programmes, which in the end, overlap contradicting activities that hardly meet Mexico City basin's necessities (Aguilar-Barajas *et al.*, 2016; Bojórquez-Tapia *et al.*, 2011).

Unorganised legislative rules allow a complex and over fragmented normative field (Akhmouch, 2012; Gobierno de la República, 2013). The federal, metropolitan and municipal governments perform and duplicate the same activities without any regards for environmental and conservation principles (del Roble Pensado, 2001; Martinez & Bandala, 2015; Ruiz-Gutierrez, 2012). In the case of Mexico City, SEDUVI is the main responsible for Conservation Land but has no relation to any environmental agency. Therefore, it tends to focus on the economic development of agriculture and forestalls activities leaving a gap over natural resource management (Arizaga-Guzman, 2002). Lerner *et al.* (2018) explain that urban development and environmental agencies focus on watershed protection and water agencies in infrastructure and services, which leaves gaps in certain areas where both domains intersect, such as water scarcity and floods. This weak management can be explained through the cognitive norms, as environmental concerns emerged due to international pressures (Godau, 1985). Therefore, environmental protection plays a political role rather than a real concern to stop environmental degradation.

As a summary, two institutional domains must work together to manage integral water resources: water agencies and environmental institutions. However, these two types of organisations work within a series of contradictions and voids that leaves unprotected water natural resources. This problem escalates as environmental institutions barely cooperate. The relationship between the two types of agencies is examined through the case-studies.

2. *Technologies and infrastructure*

IUWM relies on adaptable and flexible infrastructure that can cope with extreme weather events and safeguards water supply (de Haan *et al.*, 2015). These approaches can be considered a decentralised water system that can complement the conventional (grey) infrastructure (Ferguson *et al.*, 2013; Fletcher *et al.*, 2014). Hence, one of the main goals of IUWM is to manage rainwater in-situ, instead of conveying it somewhere else. This water can supply services in the future, while alleviating the use of networks of pipes, and consecutively, the maintenance and operation cost of centralised systems, because water loads are reduced (Fletcher *et al.*, 2014; Marlow *et al.*, 2013). Hence, green and blue spaces to accommodate water excess take an essential significance in IUWM, such as the vegetation that assists in removing pollutants (CIRIA, 2007; Fletcher *et al.*, 2014; Jones & Macdonald, 2007; Karvonen, 2011). Thereby, natural elements can be considered as part of the infrastructure.

In the case of Mexico, there are a series of works, physical structures and related programmes that are implemented to conserve natural resources. After the second field trip, the extensive amount of works and constructions that exist around maintaining natural resources became evident, including in the studied water bodies. This type of infrastructure is recognised as a concept within the infrastructure sub-system. This existing infrastructure plays an important role at the point of introducing IUWM approaches because it already exists and is supported by the community and laws. However, it produces limitations towards another type of appliances that aim to conserve natural resources but do not fulfil or contradict the existing infrastructure.

3. *Knowledgebase*

IUWM implies the construction of a shared vision, governance and policy, encouraging synergies across sectors, sharing knowledge (learning from each other through social, technical, economic and ecological spheres) and planning tools such as asset management, master plans and decision support systems. (IWA, 2016; Lundy *et al.*, 2013). However, the integration of different pieces of knowledge can symbolise a significant lock-in for this sub-system because the Mexican regime depends significantly on technology as the solution to deal with water-related problems. Ezcurra *et al.* (1999) believe that this technological approach is going to be translated to restore the environment when it becomes necessary. Moreover, this can be the most challenging sub-regime to change due to its invisibility and lack of transparency (Ávila-García, 2016), but it is important to study the knowledge that exists about these water bodies, the rationale around them and how knowledge is managed.

4. *Financial Resources and users*

IUWM promotes fiscal measures to ensure water distribution to the highest socio-economic users, as domestic users and industry. However, this approach requires enormous economic and time investments, especially from governments as it deals with river basin scale (ARUP-Urbanlife, 2011). This already happens in Mexico, as a series of financial programmes exist to reduce environmental degradation and decrease urbanisation costs (Ley Ambiental del Distrito Federal, 2000). That means some compensation payments are made to landowners to maintain the natural resources and to prevent the transformation of natural land into agricultural or urban lots. According to the Federal District Environmental Law, the municipalities can perform conservation works in natural protected areas, unless the protected areas are considered communal land, which management belongs to the communal landowners (Ruiz-Gutierrez, 2012). Therefore, these communities are paid to develop some environmental practices (Perez-Campuzano, Avila-Foucat & Perevochtchikova, 2016). However, these also create some struggles about who is responsible for environmental management:

> *(Governments and agencies) must respect everything...the environmental (river) flow.... the forests as well...There are conflicts if farmers are organised and complain because they do not want to give up their water, (they are) put in jail... (Interview C).*

This topic becomes complicated as water conservation does not generate revenue or an incentive to maintain it. Also, federal and local authorities have implemented environmental protection policies through voluntary programmes, following international trends towards social inclusion (i.e. PES, Payments for Environmental Services Programme, UMAs, Management Units for Conservation and Sustainable Use of Wildlife and FOCOMDES, Communitarian Funds for Rural Sustainable Development Programme) as described by Perez-Campuzano *et al.* (2016). However, these voluntary environmental programmes have little enforcement and have contributed further to the increment of overlapping and contradictory activities (Perez-Campuzano *et al.*, 2016).

5. *Participatory Governance*

IUWM implies transdisciplinary and multi-stakeholder participation because it involves active and sensitive involvement of stakeholders towards efficient water use behaviours or alternative provision-consume patterns (Lundy *et al.*, 2013; Sharma *et al.*, 2012; Wong & Brown, 2009). Additionally, it has been recognised the involvement of stakeholders to ensure acceptance, ownership and commitment for the success of IUWM planning process (Pearson *et al.*, 2010).

In the case of Mexico City, citizen participation[15] is already happening as it has been incorporated in the Mexican Policy, as detailed by Serrano-Rodríguez (2015). According to this author, public participation was a response to a political crisis of an authoritarian government that concentrated the power in the

[15] This form of participation involves the citizen in the public administration. Here, the citizens have the power of initiating laws, referendums, plebiscites, consultations, recalls, even to cooperate in services provision and elaborate public policies (Serrano-Rodríguez, 2015).

president. Also, international pressures promoting decentralisation processes helped to transfer power to municipalities, which opened possibilities for the community to interfere in these matters (Jiménez-Cisneros & Torregrosa-Armentia, 2007; Serrano-Rodríguez, 2015). Since 1977, the institutional and legal framework that supports citizen participation has been considerably growing (Serrano-Rodríguez, 2015). In the water management, water users were incorporated in water management decision making in 1981, after the National Hydraulic Plan was issued (Castro, 2006: 36), and then, this participation was reinforced in 1995–2000 National Water Plan (Aguilar-Barajas *et al.*, 2016: 112) and in the incorporation of IUWM policies in the 2004 reform (Terregrosa & Jimenez-Cisneros, 2009). Some associations were organised as an attempt to democratise resource management in the country (Irrigation Districts, Basin Authorities and Basin Councils) (Akhmouch, 2012; Barkin, 2011; Van-Lindert & Verkoren, 2010). However, these did not have the expected impact on water policy due to the lack funding and legal structure, while significant decisions are always led by CONAGUA officials (Aguilar-Barajas *et al.*, 2016; Terregrosa & Jimenez-Cisneros, 2009). Furthermore, community participation is restricted to only the users or agents who have power in water management (Akhmouch, 2012; Barkin, 2011; Villada-Canela *et al.*, 2019), so ordinary urban citizens cannot participate within these organisations. In Mexico City, SACMEX represents them.

Some options are opening to include citizens in decisions, as in the studied cases, but community participation is very restricted in Mexico. Castro *et al.* (2004) describe that public participation is limited because it is generally understood as public submission and acceptance of already taken state decisions while Serrano-Rodríguez (2015) adds that it relates to a lack confidence in political institutions. Also, there is a considerable political and institutional incapability in developing these programmes that tends to ignore the wide variety of social characteristics and the community needs (Villada-Canela *et al.*, 2019). Also, political party practices can bias this process, as communities tend to be shaped by patron-client relationships in relation to authority figures (Ramos-Mejía *et al.*, 2018). Therefore, most of society cannot afford to participate meaningfully in the decision-making process (Castro, 2007). Additionally, Mexico´s public participation programmes are seen as an obligation, a task that should be done, but not as a deliberate effort to incorporate the community in the decision making (Aguilar-Barajas *et al.*, 2016).

6. *Public policies, political power and struggles*

IUWM comprises a series of concerns that range from technical, economic, environmental hesitations to social acceptance and institutional capability, thereby an integrated policy is necessary (Livingston *et al.*, 2004 referenced in Chen *et al.*, 2011). Transforming the current policy structure has become an important issue as current practices have been limited in addressing sustainability concerns. Foxon & Pearson (2008) explain that such limitations are related due to the low priority that environmental issues received in the policymaking, high complexity and the contestability involved in sustainable practices. Therefore, IUWM has been embracing reflexive governance to guide open processes and receive feedback from the social, technical and physical context (Bos & Brown, 2013). Chen *et al.* (2011)

emphasise the integration of policies concerning water management and land planning. This organisation can be represented by the Federal District Environmental Law and the Environmental Plan, the principal environmental regulations in the Federal District, because they involve land-use planning and zoning delimitations for urban, agriculture, forest, and other land use (del Roble Pensado, 2001; Perez-Campuzano *et al.*, 2016). However, the political integration is difficult to achieve as the current policy in Mexico City is characterised by intense contradictions in the public policymaking, which difficult the management of natural resources (Perez-Campuzano *et al.*, 2016; Rojo *et al.*, 2018; Ruiz-Gutierrez, 2012).

Power struggles are not considered as relevant issues in the IUWM, as shown in Table 5.4. However, political power and struggles seem to grow as the environmental domain is included in the analysis. Meadowcroft (2011) describes that political struggles increase when the main objective of the transition is to introduce sustainable practices, while Fischer (2017) pronounces that environmental protection responds to industrial and economic benefits. Therefore, decisions about what and how to protect natural resources become a decision of maintaining power, so most of the solutions that pretend to produce a sustainable change remain highly technical because they fulfil utilitarian goals. This utilitarian benefit of the environmental conservation is present in Mexico City, where the Environmental Law defines faculties to the authorities to preserve and restore environmental stability while allowing economic benefits and social activities (Ley Ambiental del Distrito Federal, 2000).

7. *Cultural significance*

IUWM promotes basin protection and recognises water as the main design driver in urban planning. New spaces are created incorporating water management into built form and land-use planning (Brown, 2005; Coutts *et al.*, 2012; Lundy *et al.*, 2013). However, this position also recognises to change the perspective about risk and uncertainty (van-Herk *et al.*, 2013; Wiering & Immink, 2006). IUWM recognises the limited predictability of risks, so they use adaptive management to counter threats and shocks (Clark & Hakim, 2014). That means IUWM is open to the possibility that risk may not occur and recommend *'no-regrets'* or '*safe-fail´* approaches. *No-regrets* favours *´soft engineering´* practices, as the introduction of green areas or parks that would contain the excess of rainwater in case of a great event, instead of high engineering mechanisms that involve a high financial cost, such as levees to restrict flooding (Feldman, 2007b). However, this perspective is contrary to the cultural and historical idea of how risk is dealt with in Mexico City, where every flood is solved through the introduction of pipes:

> *In Mexico City… every time it rains, they try to make bigger pipes (Interview D)*

Therefore, this perspective of allowing water in the city, instead of immediately removing it, also must deal with established significances, such as water as a good and a universal right.

8. *Context*

A criticism that exists for MLP is the limited consideration of the variables that influence the regime (Lawhon & Murphy, 2011; Raven *et al.*, 2012). Therefore, this framework opens this concept to

understand influences that come from other systems such as the social system, transport system, or any other contextual variable. Also, it is considered the location and geographical limits of the existing regime and related practices, as the water system can be traced into the hydrological region or the Hydrological Region of the Valley of Mexico (RHVM) that supersedes the city basin. This is because the Metropolitan Area´s water system depends on importing and exporting a high amount of water from external basins. This super-region comprise Mexico Valley basin and Tula river basin (Martinez & Bandala, 2015), and the failure of infrastructure located 62 kilometres of distance, can create extreme consequences in the city (El Informador, 2009; Tellman *et al.*, 2018; Tortajada, 2006).

Synthesis

This section illustrates the characteristics that the IUWM needs to have in Mexico City, as it can be recognised as an emerging or transforming regime. Some adaptations were made from the water system (Table 4.2.) as it implies some cooperation between the water system and the environmental conservation domain. Also, the regime faces a structural change as participatory governance is proposed in the IUWM approaches including the users as an active part of the regime, instead of just influencing it through the market and consumers preferences. The final adaptation to the framework is shown in Table 5.5. The variables were chosen in the table maybe not the only ones that influence the water management or integrated approaches, but were the most significant ones that were found in the literature and after the fieldwork.

Table 5.5 IUWM as a socio-technical system in Mexico City

Sub-system	**Components for analysis**	
Institutional structure	Environmental Conservation Institutions	Regulative rules
	Water management organisations and agencies	Normative rules
		Cognitive Rules (knowledge)
Technologies and Infrastructure	Hydrological formal technical standards and infrastructure	
	Natural Resources technical standards and related works	
	Informal technical standards and infrastructure	
Knowledgebase	Technological and political rationality and information voids	Hidden Information Hidden activities
Financial Resources and users	Financial resources	
	"Owners"	Landowners and *ejidatarios* who own the land where the water comes from
	Users / citizens /beneficiaries	Formal and informal users
Participatory governance	Stakeholders and decision making	
Public policies, political power and struggles	Policy	
	Power struggles (translated into the social structure)	The political dimension of water/environment in Mexico Power Struggles Who has the power?
Cultural significance and associations of the regime	Paradigms	Water as an economic good Water as a social right Water as the main design driver New vision about risk and uncertainty
Context	IUWM consider as scale the basin. Here, it is considered the hydrological region of Mexico City Metropolitan area	

5.3 Summary

This chapter complements the Theoretical Framework, defining the most significant characteristics of the landscape and the regime that emerged from the literature review. The existing water system in Mexico City or regime is described recognising particularities and local variations that were included in the framework. This research understands that the analysed regime is facing some pressures from other dominant systems, recognising that it is facing a transformation or a new regime is emerging. Hence, further adaptations were made to the analytical framework, distinguishing that a series of dynamics between the water system and the nature conservation practices are emerging, but are not quite developed yet, despite the change in the governmental sphere (policy) that allow these. These characteristics are used to analyse the regime in the following Chapters.

Chapter six

6 Magdalena River Restoration Project

The Magdalena River is the only river that survives in the urban area of Mexico City. There have been pressures about restoring it and incorporating it to the urban realm due to its altered condition. These pressures became strong in the mid-2000s, when a group of academics pushed for the river restoration, while the media pressed about the river abandonment. The pressure translated into restoring the river with a methodological approach, supported by university academics, the metropolitan government and some members of the community. Section 6.1 introduces the Magdalena River and its restoration project. Section 6.2 describes the project devolvement through the Transition Management lens. This description is followed by the study of the *local* regime using the Socio-Technical Regime model in Section 6.3. The analysis of the dynamics between the experiment and the regime is described in Section 6.4. This section finalises with a summary of the findings in Section 6.5.

6.1 Magdalena River and its Restoration Project

The Magdalena River poses a contradiction, as it is essential to the city´s water supply, providing 200 litres of water per second, which represents more than 50% of the local surface water resources used in the capital (González-Reynoso *et al.*, 2010; Mazari-Hiriart *et al.*, 2014). However, this river is highly polluted and neglected (Caro-Borrero *et al.*, 2015c).

This river emerges in Las Cruces volcanic range in the southwest of Mexico City, and runs about 14.8 kilometres through Conservation Land, passing near the *dinamos* (dynamos) or what remains of four old electrical generators, and then enters into the urban area where it meets the Eslava River, its main tributary (Caro-Borrero *et al.,* 2014; González-Reynoso *et al.*, 2010; Mazari-Hiriart *et al.*, 2014). Then, the river meanders within the city, crossing several municipalities and diverse areas. Additionally, a potable water treatment plant treats one-third of Magdalena's water, supplying water to nearby neighbourhoods (Almeida-Leñero *et al.*, 2007). In late 2006, the construction of a second potable treatment plant was announced to increase the local water supply (Sanders, 2006).

The Magdalena and Eslava rivers are in good condition in the Conservation Land, but they are significantly disturbed in the transition area, where water quality decline due to the urbanisation (Caro-Borrero *et al.*, 2015b). The most significant alteration is in the lower basin, where a peripheral drain runs along the river, narrowing the channel while poorly separating the domestic wastewater from the natural flow (Grupo de Trabajo Multidisciplinario, 2008). An artificial floodplain (Anzaldo Dam) was constructed to control the Magdalena and Eslava water flow, and from here, part of the flow[16] is channelled and hidden for about 4.6km, while receiving 60 wastewater discharges (SEDEMA-GDF, 2012; SMA-GDF and UNAM, 2008). Later, the Magdalena River emerges above ground for a few blocks in Universidad Avenue, later it merges into a concrete channel, Churubusco River, and it is sent outside the city as wastewater (Gonzalez & Zamora, 2011). Figure 6.1 shows the path of the Magdalena River in Mexico City until the river flow merged into the drainage or the Churubusco River.

[16] The other part of the flow is connected to the western main drainage (Interceptor Poniente) (SEDEMA-GDF, 2012; SMA-GDF and UNAM, 2008).

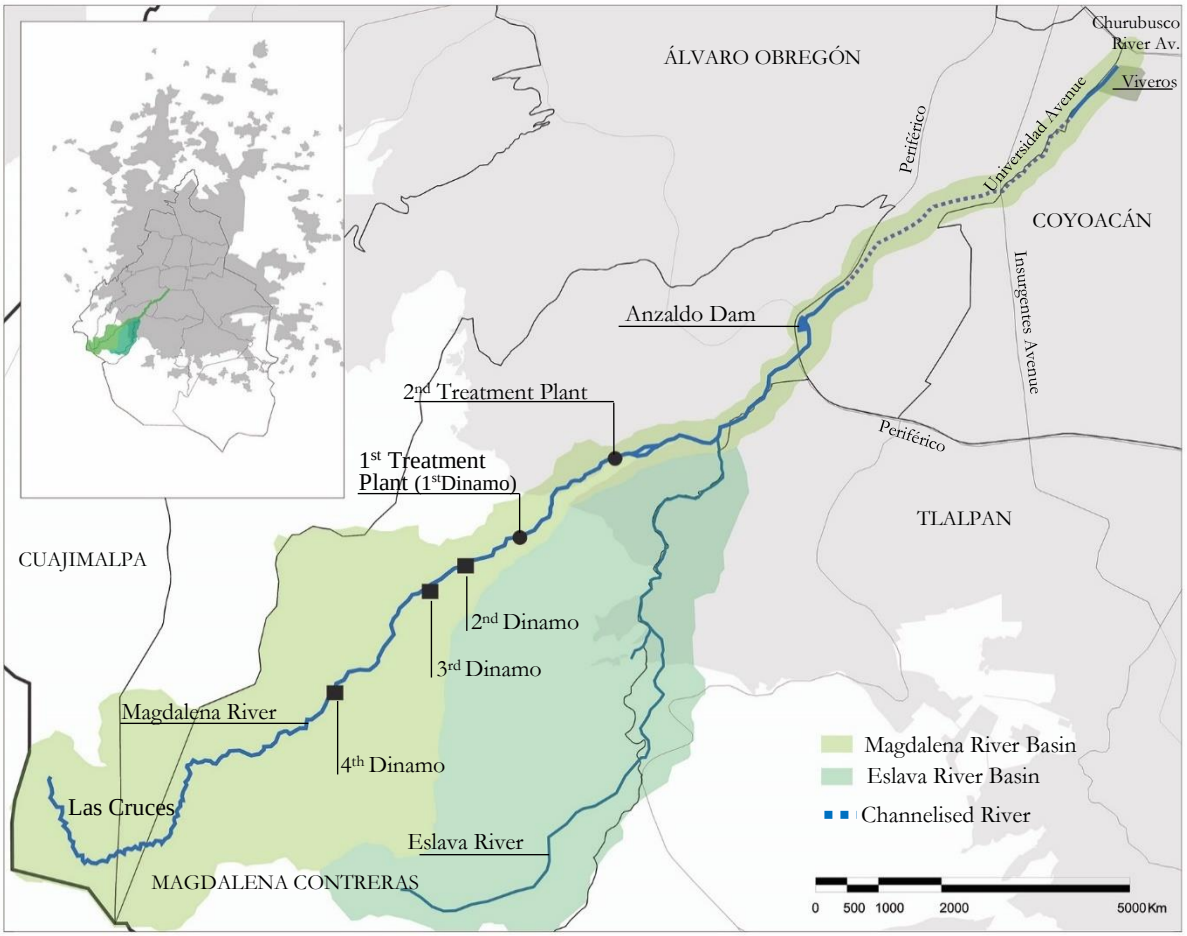

Figure 6.1 Magdalena River map
Adapted from Master Plan's comprehensive diagnostic (SMA-GDF and UNAM, 2008: PM00) and Mazari-Hiriart *et al.* (2014: 3).

The Magdalena River degradation started with the introduction of the textile and paper industry in the 19th Century, which developed hydroelectric energy through four dynamos distributed along the river channel (Almeida-Leñero & García-Juárez, 2009; Soberón-Mora, 2015; Zamora-Sáenz, 2013). A series of factories transformed the area in the most prominent manufacturing centre in Mexico City, creating a series of economic dynamics around the river and a series of conflicts in the area. Water was retained in dams and polluted with industrial chemicals, diminishing water quantity and quality in the lower basin (Zamora-Sáenz, 2013). By the 1960s, Mexico City urbanisation extended surrounding the river, and the factories closed down due to lack of energy caused by low river flow and legal problems with the worker´s unions (Caro-Borrero *et al.*, 2015d; Zamora-Sáenz, 2013). From that moment, the Magdalena River collected municipal wastewater instead of industrial pollutants (González-Reynoso *et al.*, 2010). Urbanisation pressure is still present, diminishing the natural area around the river and aggravating the river degradation (Mazari-Hiriart *et al.*, 2010; Sosa, 2015).

There have been some attempts to recover the Magdalena River, the most significant being the introduction of eight kilometres of drains in the river margins to eliminate domestic discharges into the

natural flow in the 1990s. Legorreta (2013) states that this solution was ineffective because a surveillance programme did not accompany it, so new domestic discharges emerged in the restored river sections and new sections. During the 2000s, the idea of restoring the river retook importance.

In 2007, the Mexico City government and the National University announced their participation, in a project to restore the Magdalena River (Reforma-Staff, 2007b). This project took the official name of *Master Plan for the Integral Management and Sustainable Use of the Magdalena and the Eslava river basins*. This project proposed the Magdalena River's hydrologic restoration and the enhancement of public spaces around this river. The Conservation Land would have zoning proposal, restricting activities while defining an eco-touristic area in two existing parks (Los Dinamos and La Cañada). Then, a Linear Park would run next to the river reaching the Anzaldo Dam, which would become a renovated reservoir with treated water and new aquatic vegetation. Where the river is channelled under the streets, a symbolic promenade would show where the river used to flow. Finally, once the river emerges gain, the walkway becomes a river promenade, where the extension of water increases and becomes a central feature for the street and Viveros Park (Mazari-Hiriart & Meza-Paredes, 2011). This was accompanied by the Eslava Master Plan, which focused on restricting urban growth and protecting the Eslava watershed through agriculture projects and other production plans (Chavez-Cortes, 2015; Gómez-Durán, 2009; Roldan & Sevilla, 2014). From the hydraulic point of view, the Eslava´s plan proposed gabion dams and closed ponds in the upper basin, education programmes and the reincorporation of treated water into the river flow (Gómez-Durán, 2009; PAOT, 2014).

The Master Plan stated five strategies, 14 objectives, 35 actions and 254 projects for the Magdalena River, and five strategies, 19 actions and 250 specific projects for the Eslava River (SEDEMA-GDF, 2012; SMA-GDF and UNAM, 2008). The strategies for the two rivers are shown in Table 6.1, and the sub-strategies for the Magdalena River are displayed in Annexe I (p. 294).

Table 6.1 Master Plan: the five strategies for the Magdalena and Eslava River
Source: SEDEMA-GDF (2012) and SMA-GDF & UNAM (2008).

Strategy	Magdalena River	Eslava River
1	Eco-systemic management and sustainable local development	Natural resources management and conservation
2	Comprehensive management of the river and its hydrological basin	Environmental risks protection and Prevention
3	Urban Landscape re-evaluation of the river	Public use, nature tourism and recreation
4	Territorial order for the rescue of the Magdalena River	Urban structure and services
5	New governance to help implements and monitor the reuse of the river	Urban sprawl containment

Master Plan: the five main strategies for the Magdalena River

1. Eco-systemic Management and Sustainable Local Development

   This strategy emphasised recovering and conserving the ecosystem services of the upper basin or Conservation Land. It proposed severe restrictions in the area, zoning delimitations and regulations to the tourist and commercial activities, restricting them from spreading upstream. The primary objectives in the area were to protect and to conserve the natural area, establishing related works to be performed by original town residents living in the Conservation Land (SMA-GDF and UNAM, 2008).

2. Comprehensive management of the river and its hydrological basin

   This strategy describes the objectives of maintaining springs and the river in the Conservation Land, cleaning the water, protecting the river and maintaining a basic natural flow. This strategy emphasised the need to do more studies about the river as the second potable plant represented a risk for the flow during the dry season. The Master Plan proposed adapting the two potable plants capacity to allow the Magdalena to maintain a minimum flow while introducing treated water into the river. Therefore, a series of treatment plants along the river would improve the river water quality and quantity (Almeida-Leñero *et al.*, 2007; Orta-de-Velásquez *et al.*, 2008; SMA-GDF and UNAM, 2008).

   This strategy displayed some inconsistencies. Initially, the project proposed the construction of eight treatment plants and the modification of the existing river peripheral drain (new segments and drain rehabilitation) to cope with the treatment plants. The numbers of treatment plants changed to three, but not the related works for the drain. Moreover, this strategy referred to the excessive number of gabion dams in the Conservation Land, proposing to stop further constructions.

3. Urban landscape re-evaluation of the river

   This strategy described the *Magdalena river urban and environmental plan*, a detailed plan that comprises the two linear parks: *La Cañada and Magdalena River Park* (SMA-GDF and UNAM, 2008).

4. Territorial order for the rescue of the Magdalena River

   This strategy focused on the natural land conservation and informal settlements, proposing to improve the conditions of old settlements, removing newer settlements and limiting urban growth towards the upper basin (SMA-GDF and UNAM, 2008). The strategy did not say how to carry on such relocations and evictions. Also, this section proposed land expropriation due to landslide risk, to place the linear park and other project´s works.

5. New governance to implement and monitor the reuse of the river.

   This strategy stated the creation of an operational body and its institutionalisation (SMA-GDF and UNAM, 2008). This body would be responsible for the plan's evaluation and actualisation, allowing the project's adaptive management through a monitoring system (restoration advances) and three follow-up mechanisms:

   i. A certification system that evaluates the implementation and the inclusion of new projects
   ii. Public participation from the advocacy group, an urban observatory and budget allocation through community participation
   iii. Normative, finance, promotion and management tools

The Master Plan included a Plan of Immediate Actions, detailing priority projects that would impulse this plan continuation to further periods (SMA-GDF and UNAM, 2008). Table 6.2 lists the priority actions and projects to be implemented in the short term, from 2009 to 2012.

Table 6.2. Magdalena River Restoration´s Plan of Immediate Actions.
Information obtained from the Report of Mexico City's Ministry of Environment (SMA-GDF, 2008) and Mazari-Hiriart & Meza-Paredes (2011)

Actions	Projects	Description
Conservation works at the upper river basin		The Environmental Ministry sponsored two agriculture groups (*Ejido* San Nicolás Totolapan and communal landowners of Magdalena Atlitic) to develop conservation practices in the Conservation Area
Hydraulic restoration	Hydraulic solution: Marginal drainage/ sewage pipes assemblage and treatment plants	Drainage/sewage pipes assemblage along the river (collecting the wastewater from private and public drainage that discharges into the river´s watercourse) and the construction of three treatment plants
	Indicators System for the restoration programme	Ecological indicators for the river monitoring developed by the National University (UNAM)
Public spaces recovery	La Cañada Estate - building restoration	A restoration project for La Cañada former Estate building, allocating a Site Museum, a House of Women and a Cultural centre.
	La Cañada-Foro Cultural linear park	The first stage of the linear park, which would later go from La Cañada park to Anzaldo dam.
	Chimalistac-Viveros Park	River regeneration project in the *"Paseo del Río"* Street. This project consisted of incorporating the river into the urban pattern using treated water (from a new treatment plant) and a promenade.

6.2 Project development

The Transition Management framework states four stages for the project development: transition arena conformation, visioning, steering process and monitoring/reflexivity (Loorbach, 2010). These match with the development of the Magdalena River Restoration Project stages, as shown in Figure 6.2.

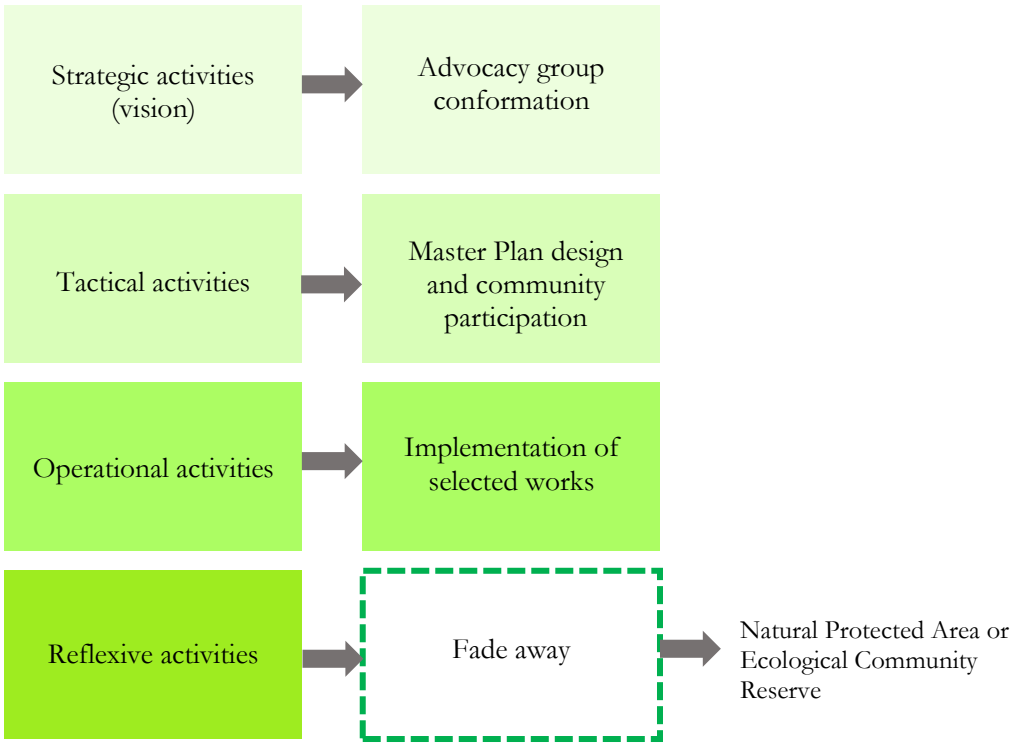

Figure 6.2 Magdalena River activities seen with the Transition Management lenses.

6.2.1 Magdalena River Restoration Project and Transition Arena conformation

This project emerged in the University Programme of Studies on the City (PUEC), a research centre of the National University (UNAM). After attending an international congress of sustainable urbanism and urban rivers, the director of such centre (Manuel Perló) realised that a project could be implemented in the Magdalena River in Mexico City (RM01). From that moment, academics of this centre gathered information about this river and lobbied for a restoration project (Interviewee A and RM01). The project was also presented to the new Mayor of Mexico City and his team. Suddenly it became part of the city's political agenda:

> *They were interested, but there was not an answer. The newspaper Reforma brought out the news that the… Magdalena River, the last living river, was running out….The next day, the Mayor said: "no, no, no, no, it is not going to die (the river), we already have the University…making a proposal" (Interview A).*

The Mayor delegated the project to the Environmental Ministry (SEDEMA) that worked with the involved academics (Interview A and RM01). They set the main strategies for this project, detailed in Table 6.3.

Table 6.3 Strategic Activities for the Magdalena River Restoration

Activity	Concepts and ideas	Description
Vision Development	Master Plan	Deliver a spatial and temporal structure for the management, conservation, use and restoration of the river and the basin, envision the Magdalena basin comprehensively (forest and urban area) and prioritise the environmental value of the river.
Strategic Discussions	Shared responsibilities (Advocacy Group)	An interdisciplinary and inter-institutional group comprise of the community and the experts that have worked in the river. This group would encourage a discussion for the Master Plan formulation.
Long-Term Goal Formulation	The institutionalisation of the project	Achieve the implementation of this plan and the river management for 20 years. Then, replicate in different basins, triggering the restoration of other rivers, and gradually transforming the water system
Collective Goal and Norm Setting	Formulation of objective vision	An objective vision that aligns the expectations and viewpoint of different actors to create an inter-sectorial plan around to restoring the river environmental value and its natural functions. Hence, restoring the river and its natural basins
	Reference Terms	The base for the Master Plan design, stating the components and direction of the Master Plan (index).
	Legal framework	Two legal frameworks supported the plan, the Green Plan (2007) and the Water Sustainable Management Plan (2007). Also, a new structure would coordinate the involved agencies.
Debates on Norms and Values	Historical background that influences the existing condition of the Magdalena River	
	The project can be implemented, but there was a not enough experience in the country on the River Restoration	
	Monitoring and evaluation through a System of Indicators	
	Interest from the community and members of the government	
	Who was going to be the beneficiary (Landowners vs city)	
	The Eslava River, the main tributary and primary source of pollution, was included in the projects	

Vision development

The project vision was to design a Master Plan that would deliver a spatial and temporal structure to the management, conservation, use and restoration of the river and its basin (SEDEMA-GDF, 2008, 2012: 14). This plan considered a comprehensive vision of the basin, including the upper basin (or conservation land) and the urban area downstream (Interview A and RM08), while the vision involved preserving the environmental value and environmental functions of the Magdalena River (RM07 and RM14). This was "a *guide of what to do and how to prioritise the actions"* to conserve the river (RM08).

Strategic Discussions

This Master Plan was conceived as an interdisciplinary and multi-objective instrument that would be accompanied by broad social participation and inter-institutional coordination (SMA-GDF and UNAM, 2008). The community involvement was prioritised to generate support for subsequent phases (González-Reynoso *et al.*, 2010; SEDEMA-GDF, 2012: 36), as it was intended that the care and preservation of the basin will be a shared responsibility between citizens and government for the long term (SMA-GDF and UNAM, 2008). In January 2007, the Environmental Ministry (SEDEMA) promoted and invited all those who may be interested in rescuing the river, social organisations, *ejidatarios*, communal landowners, neighbours, consultants and academic institutions, among others (Zamora-

Sáenz, 2013: RM07) and set up the *Advocacy Group for the Magdalena river basin rescue* (SMA-GDF and UNAM, 2008; Zamora-Sáenz, 2013).

On June 5th, the Advocacy Group was formally comprised, directing a citizen network under the same objective of restoring the Magdalena River (Grupo de Trabajo Multidisciplinario, 2008). This Group was comprised of 200 actors (SEDEMA-GDF, 2012: 14-15) and held two plenary sessions, where the preliminary outline of the programme was presented, and the organisational structure was defined (SMA-GDF and UNAM, 2008). However, this advocacy group was characterised by low community involvement, and through time community participants diminished while the number of political actors grew. Zamora-Sáenz (2013) describes that this happened because the group had no clear objectives, working rules and its role in the river restoration was unclear. Participants were not sure why they had been invited to participate, while existing NGOs demanded to be part of the project, showing interest on the money involved rather than a real concern about the river (RM08). RM08 describes that this stage became a "*circus of actions*" as everybody wanted to do something but without any interest in doing actions related to each other or the river restoration.

Long-Term Goal Formulation

The academics from the PUEC emphasised the importance of the project institutionalisation and the establishment of a committee to follow up the progress and protect the project through political changes (Ramos, 2008a). As a means, it was vital to achieving the inter-agency cooperation and the introduction of mechanisms to induce the integration and cooperation between the five municipalities that comprise the micro-basin (RM01). Then, it would be possible to reshape the governance of water management in Mexico City, as a successful case would trigger the recovery of other urban rivers in the region and the country (SEDEMA-GDF, 2012: 14; SMA-GDF and UNAM, 2008). Interview A describes that the idea behind this restoration was to start with micro-projects or to rescue certain elements to change the water system gradually instead of proposing the transformation of the whole system directly.

Collective Goal and Norm Setting

The collective goal was defined through a shared objective vision of the river, comprising the views from different stakeholders about how they visualise the Magdalena River. This objective vision was defined by the Advocacy Group, which decided on the restoration of the river environmental value and its natural functions as the primary goal. Hence, this project´s focus on the river and its natural basin (RM07). The Advocacy Group stated the Reference Terms (or Document Zero) for the Master Plan (SMA-GDF and UNAM, 2008; RM07). In a document called *Let's Save the Magdalena River*, this group defined the primary components for the Master Plan (SEDEMA-GDF, 2008), which became the framework that would oversee this plan (SEDEMA-GDF, 2012; RM08). This document emphasised that community involvement, monitoring and evaluation should be accompanying each part of the project and that instrumentation should be designed to facilitate the development and execution of the

projects established in the Master Plan (SEDEMA-GDF, 2008). RM01 states that this was a flexible framework, as this plan was intended to comprise a series of recommendations or guidelines. The goal was that agencies and authorities adopted the plan instead of a series of rules that stated what they should do.

The Sustainable Development Cabinet was created to link the Environmental Ministry, the Urban Development and Housing Ministry (SEDUVI) and Works and Services Ministry to carry out inter-agency work. Also, the restoration project was supported by Mexico City´s 2007 *Green Plan* and the *Water Sustainable Management Plan*. The *Green Plan* describes the environmental public policies for a middle-term (15-years) besides the relative strategies and actions (Quiroz-Benítez, 2013; Ruiz-Gutierrez, 2012). This plan incorporated the Magdalena River project in the strategy entitled *Restoration and Conservation of Ecosystems of High Environmental Value*, which describes the intention to completely reverse the degradation of the Magdalena River basin within six years (SMA-GDF and UNAM, 2008). The *Sustainable Water Management Programme* expresses the need to save the urban natural heritage and take advantage of its ecosystem services (Chelleri *et al.*, 2015; SEDEMA-GDF, 2012; SMA-GDF and UNAM, 2008).

Debates on Norms and Values

The main idea was to introduce the sustainable management of the river and the basin, restoring the river flow, reducing negative impacts and renovating the hydrological memory of the river (SEDEMA-GDF, 2012). However, there are a series of existing cultural, social and historical dynamics that continue shaping the relationship of the river and the city. Therefore, to rehabilitate this water body, it would be necessary to change the existing paradigm, eliminate the conflicting relationship between society and water (SEDEMA-GDF, 2012: 36) and overcome the prevailing cultural and technological inertia in the area towards the river (SMA-GDF and UNAM, 2008).

One of the reasons that the government of Mexico City adopted this project was that it could be implemented (RM01). RM01 recalls that this was not the first attempt to recover the Magdalena River, there had been previous initiatives circumscribed to the municipal level, but without any significant result. Still, there is reduced experience in the country in restoring rivers, so there are not proven methodologies and protocols. Furthermore, this was the first intervention with such ambitious goals (Interview A). Therefore, it was necessarily a technical and scientific evidence base to provide the implementation, monitoring and evaluation of the actions performed to restore the river so that they can be adjusted (RM02). A system of indicators on the river recovery that measure the implementation of actions and their repercussion in the basin would ease the evaluation and the inter-agency coordination (RM01; RM08).

Another consideration was that the community is interested in maintaining the natural area and it is aware that if the river disappears their lifestyle is going to deteriorate, so they want to maintain the river (SMA-GDF and UNAM, 2008; RM02; RM14). However, the regime (water system) had specified their

interest in continuing to increase the utilitarian purpose of this river. First, there was a discourse that justifies the increment of water supply, as just a fifth of the flow was used and the rest of the flow was disposed of into the drainage (SEDEMA-GDF, 2012: 4; RM04). Second, there was a parallel project, a second potabilisation plant that has been presented to the Legislative Assembly by the Water System Agency (Reforma-Staff, 2007b; Sosa, 2007). This plant would extract more water from the river and increase the water supply in the Magdalena Contreras Municipality (Sanders, 2006; RM01). Therefore, the idea of treating the wastewater and reinjecting it into the river was conceptualised (RM14).

During this stage, the advocacy group found out that the Eslava River, the main tributary of the Magdalena River, was also the primary source of pollution, which required the intervention area to increase, and so, the number of stakeholders involved (RM07). From that moment, the Metropolitan University, through the University Programme of Metropolitan Studies (PUEM), was in charge of the Eslava River study (interview A).

6.2.2 Visioning: the Master Plan Design

The lack of protocol and rules in the *Advocacy Group* pushed the Mexico City Environmental Ministry (SEDEMA) to assign the Magdalena Master Plan design to the National University (Zamora-Sáenz, 2013) and the Eslava Master Plan to the Metropolitan University (UAM). For RM01, SEDEMA chose to divide the project as it did not want to hand all the responsibility to just one university. The Advocacy Group disappeared (Zamora-Sáenz, 2013).

In 2007, the Master Plan officially started when the economic resources were granted, the two universities were hired to develop the Master Plans, and a *Coordination Team* was put together by the Metropolitan Environmental Ministry (RM07). The Master Plan was designed through a series of activities described in Table 6.4.

Table 6.4 Tactical Activities for the Magdalena River Restoration

Activity	Sub-Activity/Participants	
Defining activities for future experiments	Technical diagnosis	Integrated and Comprehensive Diagnosis developed by the academics
	Citizen Participation	38 qualitative interviews, five workshops; 120 interviews to the whole city and 120 communication meetings. The Environmental Ministry was in charge of community involvement.
	Scientific-Technical Design	Development of five strategies Nine meetings to discuss the diagnosis, Master Plan and strategies. Master Plans was designed by the Multidisciplinary Group (academics from UNAM and UAM)
New patterns and structures (rules and regulations, institutions, organisations and networks, infrastructure and routines)	Coordination team	Team of five people and external to the governmental structure. This was a temporal structure that would accompany the project during the government term.
Involved stakeholders, networks and coalitions	Coordination Team, Community, Academics and some organisations	The Coordination Team was the link between different stakeholders.

Defining activities for future experiments

In February 2008, the *Integrated Diagnostic* was done by researchers and academics of the National University (UNAM) and Metropolitan University (UAM), using the SWOT technique (Strengths, Opportunities, Weaknesses and Threats). Then, a *Comprehensive Diagnosis* was submitted to the authorities in April 2008, within the objective vision, strategies and lines of action to reverse the river and basin degradation (SMA-GDF and UNAM, 2008). The Master Plan was designed having two parallel design processes: (1) the citizen participation carried out by the Environmental Ministry, and (2) the scientific-technical section elaborated by academics from the two universities that comprised a Multidisciplinary Group (RM01).

Community Participation

The community participation was developed through a series of workshops and discussion forums called "*The Neighbours of the River*", which aimed to incorporate proposals of different sectors of society (SMA-GDF and UNAM, 2008; RM08). A socio-political diagnostic was developed through 38 qualitative interviews and five workshops; two public perception or communication campaigns, where 20 local interviews and 100 interviews to the whole city where developed; and 120 meetings to communicate the Master Plan (SEDEMA-GDF, 2012: 21-22). However, the participants only remember the five workshops.

In February 2008, five community workshops were carried out by SEDEMA, which hired a consultancy (Consultoría Innovación, Evaluación y Estudios Prospectivos or IEEPAC) to perform them. One of the workshops was for the middle basin neighbours of *Jardines del Pedregal,* a neighbourhood near where the river is channelled. Another workshop was for the people of *Coyoacán* in the lower basin, where the river emerges to the surface and just before it is finally channelled. The other three workshops were developed with the communal landowners of the Magdalena Atlitic in the upper basin (Zamora-Sáenz, 2013). RM05 believes that the number of workshops developed for the Magdalena Atlitic responded to separate conflicting groups that exist inside this community, because this community is divided into two opposed groups that tried to control the natural resources in the area (RM02; RM06). However, these workshops were not able to deal with the existing division of the community:

> *….a "strick" separation was made ...between the landowners, and....the merchants (of the recreational park, Los Dinamos)... Then, two workshops were held, one with the landowners and others with the merchants. The problem was that in the session…the two conflicted groups arrived...One of these groups did not stay ... did not participate in the workshop, for the simple reason that the other group was there (RM05).*

Despite these workshops, there was not enough community representation. About 107 people participated (SMA-GDF and UNAM, 2008: I.25), taking into account the size of the affected population considered to be 107, 294 inhabitants (SMA-GDF and UNAM, 2008: I-9). Most of the participants belonged to the communal landowners of Magdalena Atlitic, as the workshops carried in the middle and lower basin had about ten participants each (Zamora-Sáenz, 2013). A considerable population was omitted in this participation strategy, such as the informal settlements in the upper area (RM06) and a considerable urban section between the upper and lower basin:

> *...people who also have a close relationship with the river. People who have more visibility of the river than the people of Pedregal...They have a closer relationship ...to the river and ... the basin (RM05).*

Participants RM01 and RM05 complain that such deficient community participation conveyed a series of problems during the implementation. The community concerns were reduced to a single workshop, and no feedback was given after the workshops. RM05 argues that the workshops were very disjointed from the project. The people who developed the workshops were facilitators and barely know about the project, demonstrating lack of experience in dealing with groups with power, rich men and women from El Pedregal and Coyoacán (lower basin). *"Then, they ....did not develop the workshop properly. They did not….do the same dynamics that they had done upstream" (RM05).* Also, during the community participation workshops, the linear park in Chimalistac became a conflicting point. That means, even though the people involved in the process were the neighbours of Coyoacán (RM05), they considered that this park was not a good idea because it would attract street vendors (Zamora-Sáenz, 2013).

The PUEC (who was coordinating the researchers from UNAM) received on March 14th (2008) the outcome of these workshops to be added to the scientific-technical design (SEDEMA-GDF, 2012: 21). The results of the workshop were *"discussed by the … group, incorporating some citizen initiatives and discard some others…giving arguments"* (RM01). However, RM04 cannot remember if the results of the workshop were incorporated into the plan or not.

Other activities were developed to involve the community, which were part of 254 specific projects, such as consultations or engagement activities, where young people were asked about what they want in the river, or children from different local schools collected *oyamel* tree seeds (RM08). Some of these 254 projects or specific micro-projects involved members of the local community, in particular, *ejidatarios* or communal landowners, as they were asked to propose projects that could be then supported by this macro project or Master Plan (RM08).

The work was divided, the two universities worked in different basins, and from that moment, there were two projects: the Magdalena Master Plan and the Eslava Master Plan. For the Magdalena Master Plan, there was a considerable number of stakeholders, reaching a group of 77 people. From different laboratories of the Faculty of Sciences and other institutes, such as the Institute of Ecology with Marisa Mazari, the Institute of Engineering, the Faculty of Architecture, the Institute of Geography and the PUEC, which was coordinating the research (SEDEMA-GDF, 2012; SMA-GDF and UNAM, 2008). The information gathered was presented to other departments and discussed in roundtables, proposing a vision for the river and restoration strategies. RM04 describes that every department presented ideas and possible projects. Architects proposed linear gardens, engineers proposed treatment plants to clean the river and reinject treated water back to the channel, and so on.

The complete multidisciplinary group gathered for nine meetings to discuss the diagnosis, the Master Plan and strategies, within the presence of the PUEM and other experts from the Metropolitan University (SMA-GDF and UNAM, 2008). Despite the meetings held with the two universities together, it became evident that the two plans were not equal and that the integration of both into a single comprehensive plan was done poorly (RM14). The activities developed were not the same for the two basins, as any workshop was performed with the Eslava population, leaving no benchmarks to compare both plans in this research, especially as the information related to the Eslava River project is considerably smaller in comparison to the information that exists for the Magdalena restoration.

Some of the 254 specific projects of the Master Plan were developed by some faculties of the National University (RM06). As an example, RM03 designed some eco-techniques for the cabins in Los Dynamos Park as part of his Master Degree dissertation. This actor recalls that this project was part of the Master Plan and it was intended for treating water used for touristic proposes, dry toilets and food preparation, stopping direct discharges of polluted water into the river.

The Master Plan design was conducted between November 2007 and July 2008. Then, it was submitted and received feedback from the *Coordination of the Integral Rescue Programme of the Magdalena and Eslava Rivers*, the Natural Resources Commission (CORENA), the Water System of Mexico City (SACMEX) and private consultants hired by SEDEMA (SMA-GDF and UNAM, 2008). Once the Master Plan was finished, executive projects were designed during 2009 concerning the site's priorities and the technical options suggested in the Master Plan (SEDEMA-GDF, 2012; RM07). The Master Plan was developed in the first stage of this project, but conveyed some knowledge gaps in regards to the data of the river in the rainy season. These voids would be fulfilled in the following stages (SMA-GDF and UNAM, 2008). Hence, further research and executive projects were supposedly to be developed in subsequent stages, as shown in Table 6.5.

Table 6.5 Magdalena River Project design stages
Source: SEDEMA-GDF (2012).

Stage	Period	Subprojects
I	2007-2008	Work lines 1. Master Plan, Magdalena and Eslava chapter. 2. Environmental restoration and community support work. 3. Studies and technical support projects. 4. Technical Integration Group (or Coordination Team)
II	2009	Executive projects 1. Executive project "Chimalistac-Viveros Park" 2. Executive project "Chimalistac- Viveros Hydraulic Solution" 3. Simplified cost-benefit study of Chimalistac-Viveros Park and hydraulic solution 4. Marginal drainage of the Eslava river 5. Executive project "La Cañada Linear Park-Cultural Forum" 6. Executive project "Restoration of the Ex-Hacienda La Cañada" 7. System of indicators for the Magdalena River rescue programme
III	2010-2012	Further studies and other executive projects 1. Measurement study as the base of the indicators for the rescue of the Magdalena and Eslava rivers 2. Study of the Irregular settlements management strategy 3. Executive project for the rehabilitation of the Viveros Park front-Río Churubusco

The Ministry of the Environment announced that this Plan would be submitted to public consultation during the first two months of 2009 (SMA-GDF and UNAM, 2008), a process that did not happen (RM01). The implementation of these executive projects was supposed to be in 2010, but due to an administrative problem, the funding was not granted until the following year, 2011. The project was at an impasse for a year (RM01).

New patterns and structures

This concept remained mostly empty as just one structure was created, the *Technical Integration Group* or *Coordination Team* that would supervise the project development on behalf of SEDEMA (SEDEMA-GDF, 2012: 19, RM07).

> *…the Environmental Ministry granted political support to the group...to establish communication and agreements with other agencies…The Coordination Team was comprised of the Environmental Ministry as a….project manager. We have never been civil servants, we were not within the formal structure, and we were a group of … five people ... that depended directly on the Environmental Ministry (RM07).*

Other behaviours that are common in this type of project emerged, like the increment of publicity. This restoration project and the inclusion of the universities were announced in several newspapers (Fimbres, 2007b; Ramos, 2007; Tonda, 2007). Other promotion activities also appeared, such as the distribution of goods and uniforms within the communal landowners involved in this project (RM19). Additionally, a series of ceremonies were performed, such as the one held on June 5th, 2007 announcing the official start of this project, despite that the Master Plan design work began formally in November 2007 with the signing of the terms of reference and the creation of a Multidisciplinary Group. (SMA-GDF and UNAM, 2008). Other ceremonies were performed where some equipment was distributed to the

communal landowners, celebrating the achievement of the formal agreements with the communal landowners of the Eslava basin, called San Nicolas Totolapán (SEDEMA-GDF, 2012: 33).

Involved stakeholders, networks and coalitions

The stakeholders involved were the *Coordination Team* that supervised the project design and implementation, but this was a temporal structure that should disappear when the project became established (RM01). This group, with the help of a consultancy (IEEPAC), carried the community participation section, interacting with two neighbourhoods and the Magdalena Atlitic (SEDEMA-GDF, 2012; RM07). Also, this Coordination Team worked with the communal landowners of San Nicolas Totolapán, whose relationship seemed to be more straightforward than with other neighbours, as the San Nicolas Totolapán members participated and worked directly with the leader of this Coordination Team (RM07; RM18). Despite the involvement of the *Coordination Team* with the communal landowners, these communities started to petition for their inclusion in the project (Fimbres, 2007a, 2007b), which eventually became a list of demands including housing and free water supply, as described by Zamora-Sáenz (2013). These demands may have been the reason why some financial grants and programmes (reforestation, 97 of geo-bags dams construction, 20 gabion dams construction, soil retention works and two guardhouses for the Rangers) were applied in the conservation area in 2008 (Ramos, 2008a), even before the Master Plan concluded.

This Coordination Team also worked with the PUEC and the PUEM who were the leaders of each university group (UNAM and UAM) (RM01, RM05, RM07; RM08). However, the UNAM participation finished after this stage (RM04), the System of Indicators development was the last assignment, which was developed by the University Environmental Programme or PUMA-UNAM (Interview A; RM01).

Additionally, some external actors participated in small sections of this comprehensive project. RM08 describes that there was one company called *Down Química* that was very interested in investing in the river. This company worked with a private association (*Beta Diversidad)* and sponsored a nursery, located in Las Cebadas with San Nicolas Totolapán, one of the specific projects related to the Eslava project (SEDEMA-GDF, 2012: 37; RM08; RM18). Some companies were hired to develop most of the executive projects, such as TOA (Taller de Operaciones Ambientales) who designed Chimalistac-Viveros Park (see http://www.tallertoa.com/v1/index.php?/plan-maestro/paseo-del-rio/). The participation of these actors just involved specific projects and no other relationship with other stakeholders.

No networks or coalitions were made between the stakeholders. However, some other alliances emerged relating to what can be stated as *traditional behaviours*. The *River Surveillance Committee (Comité de Vigilancia del Río)*, a group mainly comprising communal landowners, authorised the project from the upper basin until it reached Anzaldo Dam on behalf of the whole river neighbours (Zamora-Sáenz, 2013). RM12, a neighbour from La Cañada, describes that the authorities carefully selected the members of this group:

…the population of Magdalena Contreras, we were never asked (about the project), except for the Surveillance Committee…who signed and approved it in exchange for work, to paint the church and water supply (RM12).

6.2.3 Steering process: the implementation stage

In 2011, the construction works started with the proposals listed in the *Plan of Immediate Actions* (Table 6.2) focusing on three main actions, as shown in Table 6.6. However, not all the works resulted as planned, and a series of constraints appeared during this stage. The most visible problems were the community objections raised around this project, which mainly related to the lack of information displayed.

Table 6.6 Operational activities for the Magdalena River Restoration

Activities	Sub-activity	Description
Experiments and actions	Eco-systemic Management and Sustainable Local Development	Specific projects for the Magdalena and Eslava basins: gabion dams and geocostal dams, roads rehabilitation and reforestation, among other activities.
	Hydraulic Restoration:	Wastewater Treatment Plant
		Marginal drain
	Enhancement of the public space	La Cañada-Foro Cultural linear park
		Chimalistac-Viveros Park (implementation started but was not finished)
Behaviours and practices that introduce or operationalise new structures, culture, routines, or actors	No sub-activity	The Coordination Team debilitated, and external political influences affected the project. No legal/administrative framework was developed

Experiments and actions

The developed experiments and actions were: (1) the Eco-systemic Management and Sustainable Local Development (strategy 1) comprised a series of environmental programmes and works involving the communal landowners of Magdalena Atlitic and San Nicolás Totolapan; (2) the Hydraulic Restoration (strategy 2), defined through the implementation of treatment plants and marginal drains; and (3) enhancement of the public space adjacent to the Magdalena River (strategy 3).

1. *Eco-systemic Management and Sustainable Local Development (Specific Projects)*

Some specific projects of the Magdalena Master Plan were implemented to tackle the two main goals of this strategy: (1) works that would improve the environmental condition of the basin, and (2) create jobs that increase the socio-economic conditions of the *ejidatarios* that lived in here. Thereby, gabion dams and geocostal dams were placed to retain soil, roads rehabilitated, reforestation programmes implemented, and firefighter's camps built in the upper basin (RM08 and RM13). Some similar programmes and actions were implemented in the Eslava basin (RM18). RM08 describes that some of these projects emerged from society, and the restoration project was just funding them. Sometimes the

resources came from other agencies, such as CORENA (RM13), so the corresponding authority was the one to decide which projects were carried out (RM08). As an example, a small factory called *"La Magdalena"* emerged. This factory proposed by the Magdalena Atlitic community aimed to sell water from the river (RM08) This factory was constructed in 2007, but it was never put into operation due to licence problems (RM06; RM08). However, for RM06 this factory and the related water extraction would increase water availability problems[17].

Some contradictions emerged as the plan emphasised to diminish the number of dams in the Conservation Land, but more gabion dams were implemented (Ramos, 2008b; SMA-GDF, 2008). The Master Plan considered introducing a series of devices and eco-technology in the touristic area of Los Dinamos (for the restaurants, food stalls and other services that pollute the river), but just the dry toilets were constructed (RM06). RM03 describes that these devices were not implemented due to bureaucratic issues between the university and the government.

Some projects developed within the Magdalena Atlitic suddenly terminated. Here, it is important to remember that one group was in charge of the internal government of Magdalena Atlitic community when the agreements for the restoration project were signed. However, the contrary fraction was the one in charge during these works, the same people that left one of the workshops because the other group was there (RM05, RM15). Additionally, the previous group in power excluded them within other members of the community, even hiring external people to execute development projects while using most of the budget for personal use (Zamora-Sáenz, 2013). RM01 describes that the Magdalena Atlitic develop these specific dynamics periodically:

> *…elected community representative, steal the money and give it to their friends, leaving outside the rest (of this community). In the next election, then the new representative...from the other (opposite) group, repeats the logic: "everything for my group, nothing for others". They are involved there since the 80s (RM01).*

Therefore, the specific projects with the Magdalen Atlitic were challenging to execute (RM07). However, this escalated because of how the government negotiated with this community, giving them every project and everything they asked without creating a mechanism to follow up the process (RM01). Hence, there is a nursery in the Magdalena Atlitic that cost three million pesos to build, but which was abandoned two years later (RM01), or it was impossible to gather a forest vigilance group with members of Magdalena Atlitic, despite the economic grant being assigned. This is because the Coordination Team requested a group of rangers with specific characteristics to the community representative,

> *"but… (the representative) brings me a counterproposal, with men over 70 years old… I deny the resource because they do not meet the minimum specifications to fulfil the work we are asking for…*

[17] This factory aimed to facilitate the river water sale by communal land owners. The Master Plan stated that the factory was viable, as it was considered to take less than 4,000 litres of water per day from a spring in the fourth dynamo (SMA-GDF and UNAM, 2008). RM06 criticises that there was already knowledge gaps in relation the river flow and the second potable treatment plant to consider the viability of this factory.

They go to another agency and take the money for the same people. They have (the money)… they discredited us. Here, the clientelistic practices prevailed (RM07).

2. *Hydraulic Restoration*

For the Hydraulic solution, the Environment Ministry transferred the Master Plan to the Mexico City Water System without the system being involved from the beginning (RM01). Some people from SACMEX designed a proposal to restore the river water quality (infrastructure), and three consultancies developed the construction works (SEDEMA-GDF, 2012). Two main projects were proposed: (1) the treatment plants that would reinject treated water into the river and (2) the marginal or peripheral drainage that would intercept the drains from houses and sewers, preventing wastewater from being disposed into the river (Almeida-Leñero *et al.*, 2007; SMA-GDF and UNAM, 2008; RM07). Here, the main problem was that the implemented works were different from what had been proposed in the Master Plan.

The Master Plan originally proposed eight wastewater treatment plants, then three, and finally, just one plant was constructed (Orta-de-Velásquez *et al.*, 2008; SMA-GDF and UNAM, 2008; RM04). A combination of factors reduced the amount of constructed treatment plants, such as the redesign process (SMA-GDF and UNAM, 2008: II-113), the community rejection in the area of Chimalistac (RM10) and the intervention of SACMEX having the final word in this hydraulic restoration project (RM07)

The Water System was going to operate (the treatment plants), hence the decision (belongs) to the Water System. "How much is it going to cost me? ... if ...all the plants I have are this type, why am I going to have a totally different technology in that plant? "....The Water System somehow imposed its water treatment alternative .... (RM07).

Therefore, just one plant was constructed in Primero de Mayo, which was designed to treat 35 litres of wastewater per second and send it upstream to La Cañada and feed the river flow (RM15). However, this treatment plant was not working after its inauguration (RM11). RM09 argues that the problem was related to the marginal drainage upstream, which was not working correctly, so it was not conducting black water into the plant.

What arrived at the (treatment) plant was not dirty...The water that was still going to the river.... was contaminated (RM09).

The problem of this marginal drainage was that the neighbours and members of the Magdalena Atlitic complained and did not let the drainage assemblage to occur (RM09; RM15). They complained about the illegality of this work and even sued the government, arguing that the works were invading the communal land (Montes, 2011; SEDEMA-GDF, 2012). This community stopped the project and confrontations became violent as people pulled out the drainage and burned the machinery (LaJornada-Staff, 2010; RM09, RM13).

> *There is this fellow… who … does not recognise it, but some people say he was the one who… ripped (the pipes) off because he was against the works…he disagreed that the community had … accepted these works (RM09).*

The pipe assemblage was completed after the community changed the internal government again (RM15). However, this pipe broke because of the river flow and the movement of the stones inside the channel, polluting the river flow (SEDEMA-GDF, 2012). Therefore, during the rainy season, the drainage conveys clean water instead of wastewater (RM09; RM11). Correspondingly, it is incapable of conveying the amount of surface water generated during that season. RM14 describes that she saw drainage well covers forced up due to the water pressure.

SACMEX introduced this drainage in a parallel manner during stage three of the project design (SMA-GDF, 2012). However, this *"peripheral drain*" was located in the middle of the river bed[18] (Zamora-Sáenz, 2013; RM12; RM14), while the Master Plan stated that this drain "*must be marginal, never to the centre (buried) and must have the capacity to conduct the total of the residual water"* (SMA-GDF and UNAM, 2008: Strategy II:127). According to RM02 and RM04, the location of this pipe conveyed further problems because this pipe acts as an impermeable layer, restricting water to infiltrate, and instead of resolving water retention it accelerated the run-off that reaches the lower basin increasing flood risk

> *…basically, in some points...it is completely cemented, then this makes the river to take much more strength and…there are problems of flooding or erosion (RM06).*

The original proposal was to allocate the pipe on one side or the margin of the river, but this location changed because there were houses in the river banks:

> *The peripheral drainage…should be built on the federal restriction, but the federal restrictions were occupied by private houses and businesses….So, we had to get into the river, something we did not want to....or we need to do something like…go (around) this house, then this other house and… it was very expensive and inefficient (RM07).*

RM14 describes that the Water Agency engineers argued that they could not assemble a pipe that goes up and down; they needed to do something within the slope to convey water. The only solution available for SACMEX and the Coordination Team was to put the drainage inside the river. This event just displayed the limited communication that existed with the stakeholders involved in the previous stage. RM05 recalls that the engineers of SACMEX argued that the Master Plan was wrong, as it stated the implementation of the drainage in the river margin, but there was no space to do so. This participant believes that the claim is right, but the lack of communication allowed them to do a project from zero or implemented what they had in mind, as there were no mechanisms to involve the academics that designed the project again.

[18] The Master Plan stablished to adequate the existing drain (SMA-GDF and UNAM, 2008), but the intervention did not recover what already existed (RM14).

This intervention was not convenient technically, as this pipeline aimed to connect some settlements situated in the protected Conservation Land (near to the second dynamo), but it did not connect all the houses, and some of them still dispose their waste into the river (RM06).

> *There is no entrance for any small pipe that reaches the large pipe. That was asked by the residents to the Water System representative... He never knew what to answer. ...Technically he told us how one pipe was connected to the other. We told him "...the big pipe is already there when are the little ones going to be connected?" (RM14).*

These problems affected the second potabilisation plant, as this plant was inaugurated, but it did not work. According to RM15, the waste and the chemicals used to purify the water in the first potabilisation plant were disposed into the river. Therefore, the marginal drain was necessary to separate these elements and allow the second potabilisation plant to work. The academics that design the Master Plan believe that this potabilisation plant did not work because it was designed in isolation without considering the dry and wet seasons of the river, so the plant was not working in its best capacity (RM04 and RM06).

Neighbours complained about the manner of installing such drainage, introducing heavy machinery inside the river (RM12; RM14), cutting down trees to create access to trucks and diggers (RM13), dynamiting the river soil (RM01) and extracting stones to be sold in other places (Zamora-Sáenz, 2013). The community demanded information to the authorities about the works, while comprising an alliance with some of the academics that were involved in the design process (RM12). These academics facilitated communication channels to the community with some authorities and agencies, like the Environmental Minister (RM12).

Concerning the Eslava River, the project involved working in the informal settlements. Here, the assemblage of a drainage pipe was the priority, because the Eslava River was already culverted, but the previous work was low quality, which represented a risk for the adjacent settlements. Here, it was necessary to excavate and assemble a new pipe (RM08; RM18).

3. *Enhancement of the public space*

The enhancement of the public space involved Chimalistac-Viveros Park in the lower basin and La Cañada-Foro Cultural linear park in the upper basin. The Chimalistac-Viveros Park involved a linear park, rehabilitating a boulevard in a street where the river used to flow, called *Paseo del Río* and the restoration of the river in Universidad Avenue and front of Viveros Park (RM08; RM10). The Chimalistac-Viveros Linear Park aimed to create a river promenade, through a new walking path and removing the excessive vegetation, like eucalyptus (RM07). In *Paseo del Río* Street, the works would only involve cleaning the central boulevard (RM07). However, this linear park and the neighbouring treatment plant in Chimalistac were stopped by the neighbours. They claimed about the illegality of these works, as the neighbourhood is protected due to its historical character (RM10). This park was classified as an

attention point during the workshop performed in Coyoacán. SEDEMA decided to carry on with it because the assigned budget had already been released (Zamora-Sáenz, 2013).

The Cañada-Foro Cultural linear park received negative opinions from the participants, as if there was no space for the drainage assemblage in the margin of the river due to the presence of houses, there was neither for an adjacent linear park.

> *This linear park is an absurdity...They cannot do any linear park because there are constructions on (each) side of the river... If you travel (along the) river, there are houses on the riversides, then where are you going to walk? (RM11).*

The recovery of some spaces to allocate playgrounds and workout machinery were proposed (Figure 6.3), to encourage the community to use these areas. In 2013, the following metropolitan administration period, the inauguration of some of these parks took place, and the new Mayor attended to the inauguration. That was the last works reported for this project (RM09). However, the implementation of these parks created the same reaction than the Hydraulic Restoration works in the neighbours, as they witnessed trees were cut just to allocate some benches and the arrangement of little gardens (RM13).

Figure 6.3 Playground next to the Magdalena River behind Foro Cultural Contreras
December 2016. Photograph by F. García-Alba

In the end, the described works were concluded, except in Chimalistac where the Mayor decided to support the neighbours. He cancelled the treatment plant and the linear park in that location (RM10).

Behaviours and practices

The project started to fade away as problems and community rejection grew. There were no new behaviours or practices developed in this stage, which may be related to the *Tactical Activities*, as no new patterns and structures were created before. The only structure formed was the Coordination Team, but its legal and economic weakness became evident in this stage. First, this team did not have any hierarchy to negotiate with other agencies (RM07; RM08), and not all the agencies were willing to follow the plan or even venture into non-traditional solutions outside their know-how of doing things (RM07). Second, the actions of this team were relegated under SEDEMA verdicts, as this agency continued taking significant decisions, like forcing the Chimalistac project. Third, the Coordination Team had to deal with many agencies, which eventually became overwhelming for the coordination team, as "…*suddenly it becomes a massive number of agencies, and inside each dependency, different functions from many directions" (RM07).* However, problems arose when the Coordination Team had to arrange for other agencies to execute all the construction works, such as the Water System or the municipalities because the Environmental Ministry has not facilities to perform such works. Fourth, the group faced difficulties as the project had no fixed budget, incrementing bureaucratic procedures because the expenses had to be authorised by the Environmental Ministry (RM07).

RM07 recalls that the coordination with other agencies was complicated, as the Restoration project was seen as a project of SEDEMA, so the responsibility to finish it, it was just of SEDEMA. Therefore, it was not odd that the Coordination Team did not find support from any other agency when they needed it, like when the team was involved in confrontations with the Magdalena Atlitic community due to the drainage assemblage in the community property.

6.2.4 Evaluation and reflexibility

The poor implementation of works caused several problems to the river, as the anger of the neighbours and the beneficiaries of this project (RM01, RM04, RM05, RM07; RM12).

> *None of the works they did had (relation) to what was established in the Plan… One of the things that were told to Aguirre (SACMEX director) at the time (by the academics), is that the works on the river would increase the potential of the floods. So, they knew that through removing the stones and digging, they were going to make that the river behaves like a slide…From the beginning of the works they knew that they were wrong (RM12).*

The weak and fragmented implementation led to undesirable outcomes in the river. The most significant impact was on the river flow, as before this intervention, the Magdalena River carried water all year, now it is dry during the dry season (RM04), as shown in Figure 6.4. RM01 states that the problem is that not all the project was implemented. After the second potable treatment plant, the river would only convey wastewater. Hence, removing polluted water without the reinjection of treated water would produce a

dry channel. The Master Plan recommended maintaining minimum water flow to preserve the river (RM01).

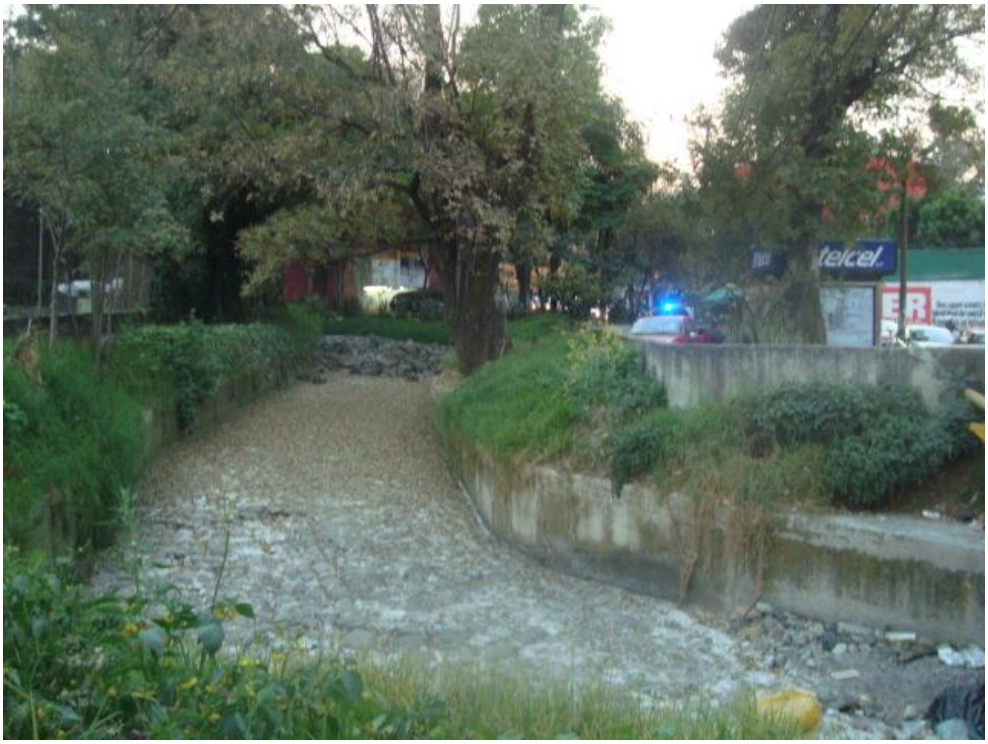

Figure 6.4. Magdalena River near Santa Teresa Street
December 2016. Photograph by F. García-Alba

In 2014, the Magdalena River was reported as polluted and the drainage assemblage unfinished as it did not reach the Anzaldo Dam (PAOT, 2014). The Environmental and Land Planning Attorney reported in 2013 that neighbour's litter clogged the Eslava River drainage main pipe and the river continued to be polluted (PAOT, 2014). Also, urbanisation processes in the upper areas of the basin continue being a hazard for the river (Sosa, 2015). Despite this negative result, some lessons were learnt and passed to subsequent stages. Therefore, this section analyses the Reflexive Activities that emerged once the project ended. These activities are summarised in Table 6.7.

Table 6.7 Reflexive activities for the Magdalena River Restoration

Activities	Description
Assessments and Evaluation Thinking about what happened after the project ended	• Legal incongruences and technical problems • The River became completely altered, becoming desiccated in the dry season • Lack of responsibility as previous projects are erased, and no one is responsible for what has been done in previous administrations (like fixing mistakes) • System of Indicators was not implemented (no evaluation implemented) • Vulnerable to Political periods. • Poor results created scepticism and more limits to future interventions in the river
Governance Processes Ongoing policies, societal changes and Lessons Learned	The Proposal for a Natural Protected Area (ANP acronym in Spanish) decree and Management Plan, or new policy to delimitate conservation zones and limit activities to protect the upper basin and the river.

Assessments and Evaluation

A series of incongruences characterised the Magdalena River Restoration project. In the legal domain, the project was contrary to the urban planning regulations in the case of Chimalistac, which is a historical borough where new constructions are controlled (RM10). Also, the marginal drain was assembled despite not having an *Environmental Impact Assessment* (RM12). RM12 describes that once that the neighbours of La Cañada could get the information about this drain, they obtain the *Magdalena River Executive Project*, which:

> *…basically, it is the description of a third work of how to make a peripheral drain, which curiously was decided in the riverbed, in the middle ...And the consequence of all this is that the river is dry right now ... The first time it dried up was when they did the works (RM12).*

Currently, the Magdalena River is highly altered (RM14), presenting strong peaks during the dry and rainy season. However, the measures of the flow are regularised and seem that there are no apparent changes in a year (RM06). This phenomenon also happened in the Eslava basin where the river became dry during the implementation phase, causing the anger of the neighbours (RM08; RM18). This was reinforced by the lack of monitoring and evaluation, as the System of Indicators was not implemented. RM01 believes that this system was not implemented as it was seen as an evaluation for the members of agencies and not a mechanism to take decisions. Also, it seems that the Water Agency does not need to be accountable for their decisions (RM08). How SACMEX implemented the project was inappropriate, and they did not change it even though some academics explained during the site visits that the river intervention would generate excessive water flow and possible floods (RM12). RM12 and RM16 state that the law establishes that SACMEX should pay for the ecological damage caused to the river[19], but it seems that they will never recognise that they altered it, while the agency director argued that eventually, the river would restore itself (Ramos & Sosa, 2013).

RM07 states that the project finished due to the political motives as the Mayor did not want to jeopardise his political career due to the conflicts that emerged around the project, so he decided to stop supporting it as a political strategy. Finally, the project faded away once that Mayor of Mexico City changed. In the following administration period, the project was not funded and forgotten (SEDEMA-GDF, 2012; RM07, RM09). The implemented works represent 10% of the whole project (RM07; RM16), despite it being catalogued as a long-term commitment and its continuation was one of the promises of the new Mayor during his political campaign (RM07; RM09). The new political period was characterised by silence in respect of the negative results of this project, as it has never occurred:

> *…. what the Water System did and the silence of the current Ministry of the Environment with Tanya Müller, simply …well I do not understand it. It has been a five-year discussion with Javier Aguirre*

[19] Ruanova (2013) describes that the concept of paying for polluting water has been a water management principle for decades, but it became a legal framework until 2011, leaving some management gaps.

> *(SACMEX director), a discussion with Tanya Müller, who has never answered a single letter…the current municipal president does not have the slightest interest (RM12).*

The main idea of restoring the river was not successful, accompanied by the small disappointments presented by the specific projects that were developed by the community. According to RM17, the projects that were funded by CORENA were also monitored by CORENA, but most of

> *…the little projects, the greenhouse...the cabins...they are all white elephants…Las Rosas (the greenhouse), do you think there are roses right now? ... The greenhouses in here are empty, they are abandoned… (RM17).*

All of these increased the resentment of the community towards the government, elevating the scepticism of the population in the idea that the Magdalena River can be restored one day, as this restoration becomes a political promise that repeats for every political administration (RM01, RM07, RM08, RM11; RM12). However, after this particular intervention, restoring the river is going to be technically more complicated and more expensive (RM12). The negative experience of the residents will stop them from trying any environmental project in the area, even finishing this project (RM01; RM07).

Governance Processes

The scheme that emerged from the restoration project studied is the Natural Protected Area decree within a Management Plan for the Magdalena upper basin. The main goal of this scheme is to create the classification of zones in Los Dinamos, controlling the activities in certain areas (RM08; RM14).

> *...so there is a project...In that project, they divide all the areas that can be for commercial use, where it is reserved and cannot be touched, another (area) that is for recreation.…they have it perfectly divided (RM11).*

This proposal can be found in the original Master Plan (Mazari-Hiriart & Meza-Paredes, 2011; SMA-GDF and UNAM, 2008), while RM12 believes that this project emerged from the meetings between the academics and the neighbours of La Cañada that occurred when the drainage assemblage happened. Currently, the project focuses on the idea of working from "*the head to the feet" (RM16)*, that means start working from the river springs and the Conservation Land, where the river is in good condition (RM14). This project was pushed and paid by the Municipal Government of Magdalena Contreras (2012-2015) that hired academics from UNAM to do a feasibility study about converting Los Dinamos into a Natural Protected Area (RM04).

This project was developed by Professor Marisa Mazari, who participated in the design of the Master Plan and an active neighbour who also helped the community to get some answers about the restoration project (RM04). This project has been presented to the community receiving a favourable response, as more than 300 people (communal landowners) attended to its presentation (RM14). RM09 describes that there have been already at least five meetings with the Magdalena Atlitic, informing them about this project and the possible alternatives, such as converting the area into a federal or a local protected area:

> *(In 2013-2014) it has been proposed to make a community…like…a REC, which is a Community Ecological Reserve…(Right now), the community is already in the process of getting payments for environmental services from recognising it as a Protected Natural Area, but…it is necessary to be approved (RM09).*

However, the scheme of the Natural Protected Area is vulnerable to politics and power struggles. RM04 describes that the central conflict is about the legal terms of this decree, as the municipality want this protection being at the federal level to restrict the influence of SEDEMA (or the metropolitan government). However, this federal classification restricts the community to manage this area (RM11), and the community want to convert it into a Community Ecological Reserve or REC (acronym in Spanish) because they can gain economic benefits from it (RM04)

> *The Protected Natural Area ... restricts us (the community)... We live from (the area)... It would generate a very strong social conflict because we would not allow it...We know a little bit about the subject, we know what can be done and what we should not do (RM15).*

The current legislation of 1932 and 1947 (see Section 6.3.6) restricts the community to be able to exploit the woods, so they have been trying to remove such protections (RM09). Therefore, this new decree is perceived as a huge opportunity for the community who wants to create a living through exploiting the forest (RM09). However, the Magdalena Atlitic community is highly disorganised (RM06), and some participants see the emergence of new conflicts inside this community if this area is transformed into an REC (RM11 and RM13). The university submitted the recommendations for the two alternatives, but the government was more interested in the elections at that time. Now, the political conflict lies in the internal organisation of this community and the two opposite groups fighting for controlling the internal government (RM04). In the last internal election, the winner was not recognised by the opposite group (RM01, RM14 and RM19). This conflict has not been solved and the ANP decree is paused (RM16).

6.2.5 Synthesis

The TM framework illustrates the project development through four stages, making visible how in each stage the project was challenged. From the beginning, the restoration scheme faced difficulties in comprising the transition arena, and despite having a broad group of academics and agency members, it failed to gather adequate community representation. Maybe that is the reason that Loorbach (2010) recommends that transition arenas should have about 10 or 15 actors. In the visioning phase, the technical design worked slightly well, as the PUEC organised it and all the participants have an academic background. However, community involvement was low because there were no norms or evaluation. That means, there were no standards about the minimal goals to achieve, the number of people to get involved and how they should be involved (RM01). Hence, disparities emerged when grants were distributed to the people of Magdalena Atlitic to develop conservation programmes, but the people in the lower basin only heard the proposal, which was even implemented despite receiving negative feedback.

The main problem came with a disruption between the Master Plan and the executive projects, due to an abrupt change of stakeholders, as concepts and ideas were not transmitted. This disruption may be the result that the project was paused for a year. Then, when the project was retaken and implemented, it became evident the fragmentation of this project and that the works had a barely any relation with the Master Plan, causing the anger of the academics involved in the design. Eventually, external variables such as the community protest, discoordination and limited support from other agencies, and the near end of the political period, forced the project to finish without reaching the expected goals nor an evaluation process. The project development is illustrated in Figure 6.5.

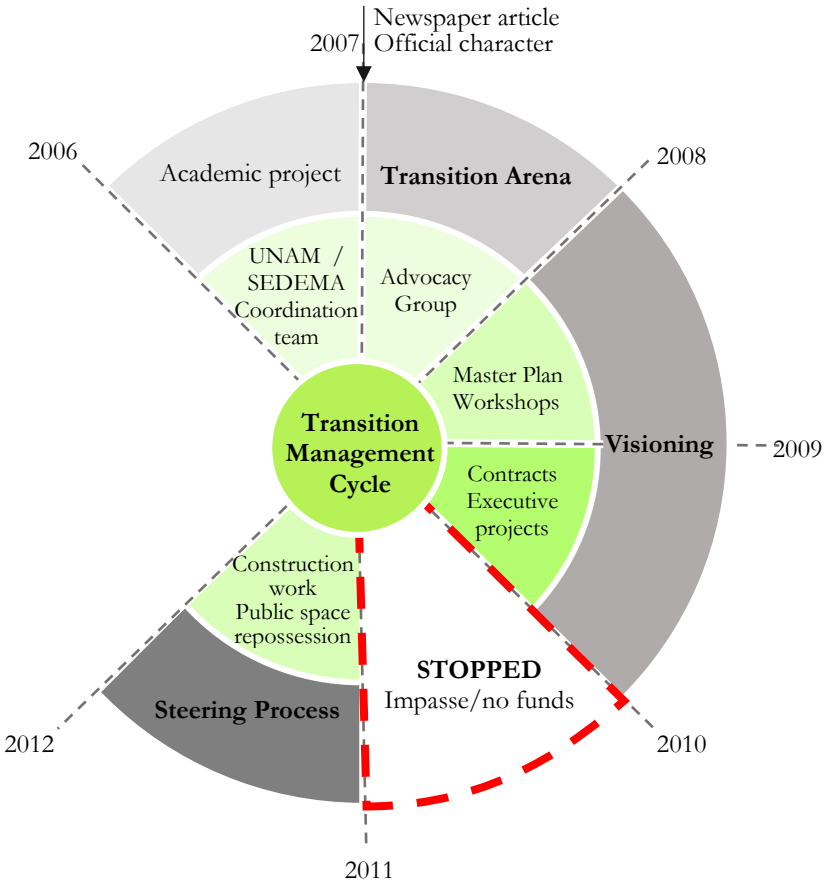

Figure 6.5 The Magdalena River Restoration Project viewed with the Transition Management Lens

Some learning passed from this Master Plan to subsequent projects in the Magdalena basin, as the project to categorise the Natural Protected Area emerged to conserve the remaining natural conditions of the river in the upper basin. Despite that this project includes the community and fosters the proper legal framework, it is very susceptible to external political variables.

6.3 The Regime behaviour towards the Magdalena River Restoration

This section focuses on the regime and its main characteristics, especially those that influenced the project. Here, the Alignment and Processes of the Socio-Technical Regime model helps to analyse the regime and how each dimension of it acted as a barrier or an enabler to the project, especially as the project represents a series of struggles to the incumbents.

6.3.1 Institutional Structure

Due to its complexity, the Magdalena River Project involved a series of different stakeholders beyond the water system, as different agencies and many directions inside each dependency (RM07; RM11).

> *…it gets very complicated because you have to coordinate many municipalities, Water System, Governance Ministry…Environmental Ministry…, SETRAVI…About the federal matter, also federal agencies … have to do with the river…Therefore, CONAGUA ….SEMARNAT...Suddenly, it becomes a huge number of agencies and inside the agencies…many offices. (RM07)*

All these agencies have different regulative rules, and such rules significantly segment and confine the responsibility of each agency, complicating the coordination of all the involved actors (RM07) or the possibility to introduce new behaviours and rules. Despite the segmenting regulative rules of these agencies, RM02 describes the main problem is that there is no authority to execute rules and penalties. Therefore,

> *Actions like (the river restoration)…that involve a lot of money, are taken but not followed in time, then they are forgotten… (while) there is no general project that integrates the whole basin as a unit (RM02).*

Therefore, it was not peculiar that the Magdalena Project was fragmented, as the agencies did not work together. RM14 expresses that the problem is more related to the normative rules or behaviours, as the agencies execute programmes that are not compatible with each other. These programmes can introduce simultaneously conservation practices and cattle raising grants in the conservation area (Perez-Campuzano *et al.*, 2016). Additionally, there is no communication between the agencies promoting such programmes.

> *The Water System does not speak with CORENA, CORENA does not speak with CONAFOR, CONAFOR does not speak with the municipality, and the municipality does not speak with… (RM14)*

In the environmental domain, SEDEMA through CORENA regularly intervenes in the upper basin through conservation programmes (RM13). Likewise, other federal agencies (RM19) and the municipality of Magdalena Contreras (RM02). The problem is that every agency work aiming to solve urgent aspects (i.e. grazing), while the upper basin is vulnerable to urbanisation and other long-term practices.

In the case of the Magdalena River project, the agencies with more visibility were SEDEMA and SACMEX. Despite that the river is a federal matter, SEMARNAT did not intervene in the Master Plan. This agency just visited the area after neighbours of La Cañada complained about the restoration works, but dismissed the problem as the river did not show alteration during the rainy season (RM12). Something similar happened with the water management agencies. CONAGUA was absent during the whole project development (Zamora-Sáenz, 2013). However, SEMARNAT intervened in 2009 with a project called *Protection and Restoration of Natural Resources in the micro-basin of the Eslava River*, promoted by the IMTA and involving San Nicolas Totolapan. This project, with no relation to the Master Plan, displayed the agencies discoordination and the limited call of the river restoration project.

Another problem that influences the management of the Magdalena River is the political periods, which force the projects to be inaugurated within the political term, limiting the support towards the project (RM01). Hence, government plans have no continuity (RM14)

> *…when it is the last year of the governmental administration. It seems that what you want is to close projects...In Mexico, we plan in six years and in six years you do not do urban projects ... In reality, when starts and ends, you lose two (years), what does remain in the middle, it is little (time) (RM08).*

These periods limit the annual budgets and shape bureaucratic-administrative logic (RM01). Thereby, the budget must be spent no matter what. RM01 describes that with this logic, plus the lack of communication between agencies, the Magdalena Contreras municipality cut down some trees on the riverbank that the Magdalena River project wanted to recover, damaging even further the poor implementation. This time limitation restricts the cognitive rules or knowledge as the government staff changes every political period. This is more severe in the case of the municipality that changes every three years:

> *…and they go and leave, and they take everything, even pencils...We (the University) have done several projects…for the municipality and they get lost… (RM04).*

The Master Plan (SMA-GDF and UNAM, 2008) emphasised the high responsibility of Magdalena Contreras municipality because of the extension of the river in this territory. However, the relationship the municipality had with the project was non-existent. The municipal president was visible while the project was being promoted (Cruz-Flores, 2006), but not involved during the design and implementation period, besides for some construction works (RM04; RM07). Then, he was required to resolve the community demands, but by this time, there had been a change of personnel due to elections meaning the new municipal president had no knowledge of the project. The lack of communication inside the regime fragments the communication towards the community. The most probably is that something similar happened in Alvaro Obregon Municipality and the neighbours of Chimalistac.

The cognitive rules or knowledge of the institutions shaped the existing behaviours while debilitating the introduction of changes, like the Magdalena River restoration project. In this case, not all the agencies were willing to venture into non-traditional solutions outside their know-how of doing things (RM07).

Hence, SACMEX continues prioritising water supply over the conservation of natural resources, putting pipes further and further away to collect water from rivers despite the environmental damage caused (Interviewee C).

According to RM01, one of the main mistakes was to assume that the government (highly interwoven with the regime) is a uniform unit, which is not. Through different agencies, the metropolitan government comprises different *"elements, logic, knowledge, attributions and conflicts"* (RM01). Additionally, this actor describes that it is also essential to add the institutional (and political) complexity, as all the involved actors and members of agencies, even though they have the same political background (political party), they do represent different ideas, fractions and interest, creating an internal problem from the origin to this project.

6.3.2 Infrastructure

The restoration project required the integral management of water services and natural resources. Therefore, this section analyses the infrastructure that provide water services and the one that aims to maintain the natural resources or conservation works, while including the informal infrastructure built by the local population in the Magdalena upper basin.

Formal infrastructure: Hydraulic Work

The Magdalena and Eslava rivers are significantly altered in the urban area through constructions that prevent floods and restrict the pollution in the river. This is the purpose of the Anzaldo Dam that was constructed as an artificial floodplain that controls flood and receives water from other diverted rivers, —Texcalatlaco River, Coyotes River and Texmaloya stream. This dam removes part of the Magdalena flow towards the western main drainage or Interceptor Poniente (SEDEMA-GDF, 2012; SMA-GDF and UNAM, 2008). Additionally, a series of marginal drains were assembled in the river edge to stop wastewater discharges into the Magdalena River. The most famous interventions were the construction of marginal drains in 1994 (Alvarez, 1994), which later was repeated in 2002 (RM12). As a result, there is a drain on the right and another on the left margin of the river (RM14). However, the drainage was severely damaged by 2007. There were leaks at 13 points, while the river continued receiving 58 direct wastewater discharges, 10 of which were constant all year round (Grupo de Trabajo Multidisciplinario, 2008). The Eslava River also presented a significant alteration as part of this river is piped in the urban area. Nevertheless, this pipe got broken several times, causing landslides and bringing houses down (RM18).

The infrastructure for water supply was the most determining factor for the Magdalena River restoration, as the whole project was already conditioned around two potable water plants. The first potable plant treats one-third of Magdalena's water, supplying water to nearby neighbourhoods (Almeida-Leñero *et al.*, 2007). A second potable plant was announced in late 2006, and it was under construction during the

project´s design (Sanders, 2006; Zamora-Sáenz, 2014). This second plant was controversial as it would stop the river's flow during the dry season (Grupo de Trabajo Multidisciplinario, 2008). The water system continued with the water plant construction as it prioritised the water supply.

> …. *favouring the water supply, even of irregular settlements, which are the ones that discharge their drainage into the river. They prefer to supply (these settlements) than to treat the Magdalena River as an ecological system (RM12).*

Formal Infrastructure: Conservation Works

A considerable number of agencies have programmes in the upper basin, promoting the conservation of the natural characteristics of the area (RM15). RM02 criticises the effectiveness of these programmes as they are implemented in a too disorganised manner, and this disorganisation is reflected in the river´s water quality. RM06 describes that these programmes tend to be harmful to the environment because they are designed not to accomplish an environmental objective but to create "*temporary employment, as they are always looking to solve a national objective, which is poverty reduction"* (RM06). Therefore, there are 90 dams on the Magdalena River and 83 on the Eslava River (Caro-Borrero *et al.*, 2015a), indicating that the number of dams increased although the Master Plan in 2008 proposed to remove them (Grupo de Trabajo Multidisciplinario, 2008). RM14 describes that gabion dams are no longer retaining the water to avoid floods downstream. Instead, the dams are retaining sediments and tend to be clogged. Caro-Borrero *et al.* (2015b) describe that something similar happens in the Eslava river, where the river presents significant changes and flow alteration due to the substantial presence of gabion dams.

Similarly, the reforestation programmes present poor environmental outcomes (RM07). RM09 describes that the Magdalena forest used to be much exploited, but the forestry ban was introduced, and it became a very dense and old forest that barely allowed the undergrowth cover to exist. Despite this condition, reforestation programmes were implemented, restricting even further the shrubs and groundcover, exposing further the soil to erosion and restricting the infiltration. Moreover, RM17 indicates that it is well known that only 8% of plants of the reforestation programmes survive. These programmes continue aiming to compensate for the opportunity cost of converting this land in agriculture parcels. However, the programmes tend to be limited as the opportunity of this land is urbanisation (RM06).

Informal infrastructure: illegal water extraction and unregulated activities

The informal infrastructure occurs in the upper basin or the peri-urban area. Here, informal urbanisation occurs and also the manner to satisfy these settlements with services (Canabal-Cristiani & Narchi, 2014). RM06 describes that there is an illegal water distribution through hoses, which was not considered in the Master Plan. Here, the owner of water springs connects hoses and sells water distributions. These practices are drying the springs that feed the Magdalena River, but this problem has been disregarded by all the management plans, as "*they count the springs, but do not realise that all springs have diversions"* (RM06). Also, RM06 believes that the Eslava River presents alterations because water is over-extracted, as she

has seen tanker trucks filling up with river water many times. This extraction has been done without considering the ecological river flow during different seasons, causing the river to desiccate during the dry season, so the Eslava has been transformed into a seasonal river (RM06). Moreover, the two rivers received wastewater from informal settlements (Fernandez-Eguiarte *et al.*, 2000 referenced in Caro-Borrero *et al.*, 2011), and even the drainage of entire urban neighbourhoods (Gómez-Durán, 2009; Mazari-Hiriart *et al.*, 2014).

Unregulated recreational activities and related infrastructure in the upper basin are affecting the rivers. Most of these activities are in the transition area, where La Cañada and Los Dinamos parks are allocated. Here, commercial stalls, vendors and visitors intensively use this touristic area, and the commercial infrastructure continues increasing without any planning upstream (Fernández-Eguiarte *et al.*, 2002). In Los Dinamos, trout producers divert the river flow and alter the water quality (RM16), while food stalls extract the river water through PVC pipes and use it for dishwashing, cooking and flushing toilets without any environmental consideration (Almeida-Leñero *et al.*, 2007; RM03). Then, *"grease, chlorine, detergents, and everything go to the river"* (RM16). The Eslava River has the Parque Ejidal San Nicolás Totolapan, and even though this park is significantly more organised (RM18), fish farms and restaurants are altering the river´s quality (Caro-Borrero *et al.,* 2015c).

There have been some works that seem to be informal but performed by the authorities. RM19 describes that CORENA diverted a stream that used to feed the Eslava River towards Tlalpan (Fuentes Brotantes). Also, RM18 recalls that the ejido San Nicolas Totolapan has worked with Tlalpan municipality in building up a lagoon to collect rainwater and supply with fresh water informal settlements. According to this participant, the idea was to stop the urban growth and that new houses do not connect through hoses to the river upstream (RM18). However, water is a federal matter and these works should have been done by CONAGUA, which seems to be unaware of such works.

Figure 6.6 shows a schematic diagram of the Magdalena River and how the infrastructure has transformed it. This figure illustrates the river as a linear system that supplies water and helps to dispose of wastewater to the drainage (Río Churubusco) and outside the city. First, springs feed the river, but water is diverted by who can be considered the owners (Magdalena Atlitic) to supply the informal settlements and unregulated activities. Then, wastewater is disposed of in the river. Also, the river flow is extracted and treated by two potabilisation plants to supply adjacent neighbourhoods. After these two plants, there is a serious disruption on the river flow. After the Master Plan, just a treatment plant was constructed (this diagram considers that the treatment plant is working). This treatment plant works as a gear in this system, as the intervention failed to contemplate integrated river management and the river as a system remained the same. Thereby, the technological know-how of the regime prevailed in this project.

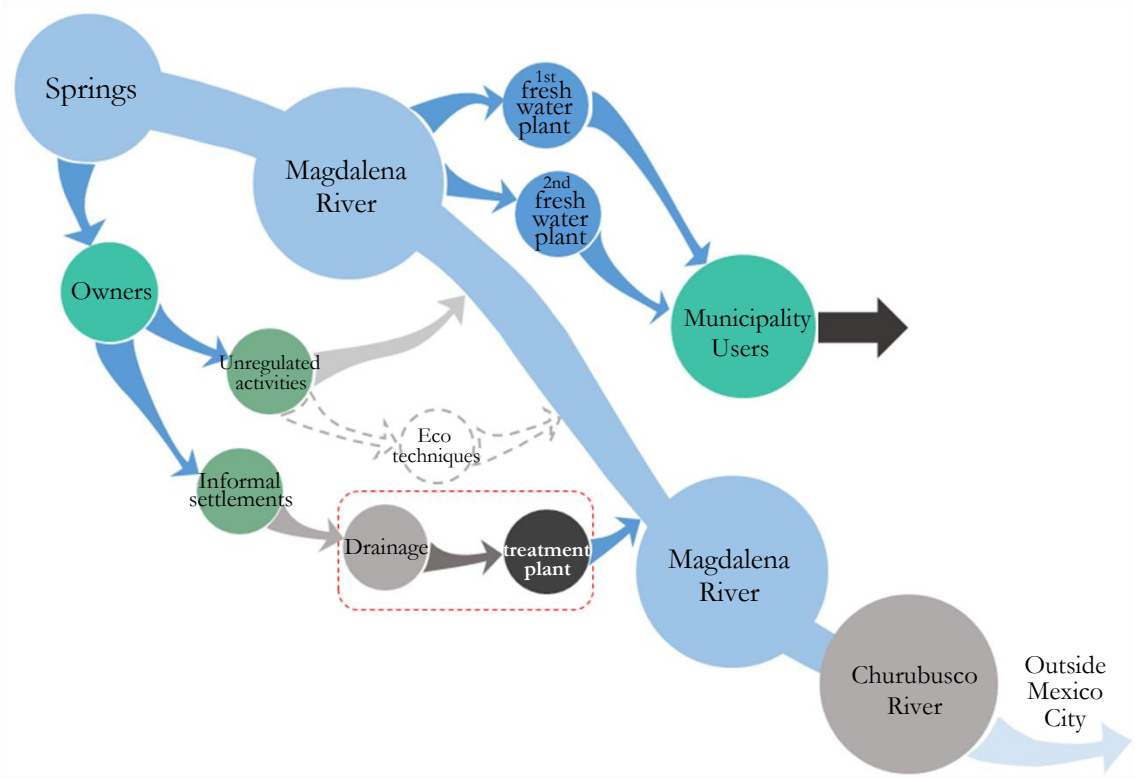

Figure 6.6 Magdalena River altered water system
The grey dash line shows the proposed but not implemented approaches, while the red line shows the implemented (but not working) approaches of the Master Plan.

SACMEX, responsible for the Water System, had a very technical vision focused on construction works (RM05). The problem is that this vision continues reinforcing the same logic of solving everything through a technological approach, using the equipment and technology that the regime knows how to use. Thereby, all the attempts that have emerged to recover the Magdalena River respond to the same logic, *"which glimpses recovering the rivers of the city, getting peripheral drains" (*RM01). This logic prevailed in previous attempts and prevailed in the 2006-2012 intervention, despite that this type of technology has proved to be inefficient (RM01, RM11; RM12). This fact displays a series of problems in the system. First, there is not an evaluation system that allows the agencies to measure the benefits of the works, and therefore adapt the used approaches. Second, as RM04 expresses, most of the agencies (especially SACMEX) implements works but in an isolated manner complicating comprehensive projects. Additionally, the agencies have the final decision about what to do and it is always related to what the agency know-how. Therefore, it is problematic that they venture to use alternative approaches (RM07).

6.3.3 Knowledge

Projects tend to be implemented with limited knowledge of what is happening in the area, which is reinforced by the informal interventions in the area, such as urbanisation. Informal interventions (like informal infrastructure) can be considered as *Hidden Information* as it lies outside the water system domain, affecting the system. However, plans are designed without contemplating these interventions (RM06).

RM13 describes that projects display a complete disregard of what is the physical condition of the site, so they are contradictory to what exists in the area. Hence, the River Restoration proposes linear parks where there are houses or throwing down some trees to allocate seating areas.

Also, there is limited information about what the regime does in the area or *Hidden Actions* (e.i. diverting water from the Eslava springs). RM09 describes that the limited results of projects and interventions are related to how the knowledge is recorded and transmitted. The information that is prioritised is the numerical targets (number of kilometres constructed or the number of trees planted), without expressing if the proposed objectives were achieved, especially when the environmental conservation is the goal (RM08; RM09):

> *Is it useful for us to do certain kilometres of work or to plant so many trees? if that work does not fulfil the planned objective, if the work is poorly executed, or if after two years it is no longer maintained and it is not working. …"Mexico ratified the agreement…and undertakes not only to reforest 300,000 trees but three million trees", and we do it. This year we did it. Did the trees survive? Do we get something out from it? (RM09).*

6.3.4 Financial resources and users

The Magdalena project illustrates that these type of ventures face financial difficulties as there is no fixed budgets for such projects in the regime´s structure (RM07). This project proposed a particular mechanism to obtain financial resources; for example, the construction and maintenance of the treatment plants were planned as a concession to private companies (RM10). This practice is common in order to allow private companies to finance the construction of the plants and then manage them, receiving the payment collected through taxes (SEMARNAT, 2011 and interview D). However, the appointment of this plant management (or concession) was not transparent and directly assigned to a company (RM10).

In the upper basin, the programmes related to the basin conservation were implemented by agencies that were already promoting environmental practices (CORENA endorsed FOCORES or Ecosystem Conservation and Restoration Funds and PROFACE, Programme for Funds for the Support of the Ecosystems Conservation). Therefore, the allocation of grants continued business as usual (RM13), while these agencies continued deciding which programmes support (RM08)

> *(These programmes) supported the projects... that were inside the Magdalena that had a link with the river rehabilitation. In a sense, (they) strengthened.... or complemented... the Magdalena River Master Plan (RM13).*

These programmes and their contributions were mainly assigned to the people who live in the Conservation Land (RM15). However, the plan obviated that some people from the nearby community are integrated by informal settlements that use the river water or dispose of wastewater into the river (RM04). Here, the problem is that these type of users may continue growing, as informal urbanisation continues in the area (RM06).

The Magdalena Atlitic is recognised as the communal landowner of most of the area that comprises the upper Magdalena Basin, while San Nicolas Totolapan owns most of the Eslava Basin (RM09, RM16; RM19). These groups received property titles after the Spanish Conquest, but they were not able to fully exploit their land due to privileges awarded to big haciendas and factories in the area (Almeida-Leñero *et al.*, 2007). In 1975, the communal goods were restored through a presidential resolution (Caro-Borrero *et al.*, 2011). Therefore, the enormous interest of the government involving the communities in the area conservation (RM01). However, as owners they feel with the right of controlling the water and the forest:

> *…we told them "hey because we receive everything…we collect all the smog and transform it and send….oxygen, we take care of the water. What would happen if we closed the water here? For example, that we had a faucet, nothing goes to (the city) anymore" (RM18).*

The involvement of the Magdalena Atlitic in the matters of the basin is quite problematic due to the internal conflicts of this community (RM01; RM02; RM04). However, the mix of residents, owners, formal and informal users in the upper basin creates a mosaic of contradictions as some of the communal landowners want to remove the irregular settlements, without realising that they live in that type of settlements (RM04). In contrast, others want to continue profiting and selling lots for urbanisation (RM15). This contradiction is reflected in the way that the conservation land is managed and owned:

> *La Cañada...in theory… was ceded to the Federal District government. They did not accept it and returned it. Right now it is in the custody of merchants…The First Dynamo...has no stalls…(and) belongs to Carlos Mora and Master Elva, they are in the group Luis Cabrera, another political group …(The land of Magdalena Atlitic communal landowners is) from the first water treatment (potabilisation) plant…(RM17).*

6.3.5 Participatory governance

Here, the community stopped the restoration works, complaining that they did not know about the project until the works started (RM10; RM11). The information about this Master Plan was restricted to the SEDEMA web page (RM01). RM06 expresses that community participation tends to be low because the participation programmes are limited, lasting as long as the economic resource or the political period last. The Magdalena River restoration project showed the limited experience that exists in Mexico in creating effective and in-depth citizen participation. This manifested when the project failed to include the citizen committees. These were new organisations created in parallel to the project, as a new law of citizen participation was introduced, and new citizens representatives were first elected in 2010 (RM01). However,

> *… that is where the administrative logic collides again. It was a project... that was considered as already finished in front of new actors (citizen committees) who had a veto capacity. ... I think this (new actor) was minimized and in the case of Chimalistac it … ended up throwing down that project (RM01).*

Community participation was not reopened to invite these committees to contribute[20]. Then, a new body in the Chimalistac neighbourhood became a significant actor in achieving meetings with the Mayor and cancelling the works in its neighbourhood (RM01). Additionally, the restoration project displayed the low level of engagement of the agencies, who tend to believe that community involvement occurs if there are some workshops with the population, even though these workshops are not inserted in the project nor the context (RM05). Likewise, RM01 believes that the problem is that the authority does not assume the cost of opening participation channels. Furthermore, it does not execute the power to create these channels and explain the objectives of the participating programmes clearly:

> *There is no clarity of operation rules....it discredits so quickly most of the participatory mechanisms ...that the government opens… (The community say) "we have no voice, we do not have votes…we come to legitimise previous decisions" (RM01).*

Community participation programmes in the Magdalena Contreras tend to be small and inefficient. First, most of the population excessively distrusts these programmes, especially when they are developed by the government (RM13). Second, these programmes do not have enough call to comprise the adequate reach (RM06; RM13). Third:

> *All the plans ... are focused only on going with the communal landowners because they are the owners of the land...they have legal and agrarian rights over the land but does not mean that they are the only ones that influence the land-use change (RM06).*

A considerable part of the population was obviated, such as the informal settlements (RM06) or the vast majority of the people that comprised the *ejido* or the agricultural community. Here, only the people who have land titles or landowners can vote and make decisions about the basin, and not everyone in the community, like the sons, brothers and other members (RM17), whilst reinforcing control and exclusion behaviours (Ramos-Mejía *et al.*, 2018). These type of programmes have a strong political background, as the participants tend to attend to support their political group and their interests (RM13).

> *Everything is very rigged, whatever agency you go …is …rigged. Everything is labelled, everything is for the compadre… for the friend (RM17).*

6.3.6 Public policies, political power and struggles

Power struggles highly influenced the Magdalena River Restoration Project, and some of these struggles are highly interlinked with practices performed by the incumbent actors. This is because different agencies promote environmental practices, but the members of these agencies are interconnected with the government structure and political cycles. Thus, they rotate according to electoral periods and they are highly involved in political matters. Hence, it is challenging to separate incumbents from government members, as they belong to both (Furlong, 2014). The problem aggravates as every agency, institution, and even political parties are comprised of diverse groups with different interest (RM01). Then, it is

[20] Some contradictions appeared in the documentation. SEDEMA (SEDEMA-GDF, 2012: 32) states that the renegotiation was opened with this citizen committee, but that did not happened according to RM01.

common to see struggles between federal and metropolitan governments, which, according to RM07, limited the possibilities of constructing the treatment plant (previously cancelled by the Chimalistac neighbours) in federal land (Viveros Park). Whilst at local levels, political struggles translated into social organisations. According to political interests, grants and programmes are assigned in the Magdalena Basin, while contributing to the community polarisation and division, as some groups are favoured with programmes, but others are excluded (RM06; RM16).

Then, the regulation is inadequate to control these struggles, as the existing policy tends to be vague. As an example, forest exploitation was forbidden in 1932 over an area of 3,100 hectares that belonged to Hacienda La Cañada and Magdalena town (Fernández-Eguiarte *et al.*, 2004 in Caro-Borrero *et al.*, 2014). In 1947, a presidential decree established a Forest Protection Zone, protecting 500 metres from each riverside, 12 km long from the river´s origin (Caro-Borrero *et al.*, 2011). However, both declarations are contradicted by the 2000 General Programme of Ecological Planning of the Federal District, which announced a much smaller area while including a private lot in such protected land. Thereby this site is not correctly a Natural Protected Area, and there is no a management plan that prevents the degradation of this site (Cantoral-Uriza *et al.*, 2007; Grupo de Trabajo Multidisciplinario, 2008). Almeida-Leñero *et al.* (2007) describe that this blurry legal definition creates an undefined administration and regulation in the upper river basin, while Caro-Borrero *et al.* (2015a) state that the absence of regulation for specific activities (arable land irrigation, food supply and trout farms) is detrimental to the quality of the river.

The weak legislation and the politicisation of the area have contributed to the creation of coalitions between incumbents, informal settlements and communal landowners that favours illegal urbanisation, as the provision of services are exchanged for votes in the Magdalena Basin (RM02, RM03, RM04, RM06; RM08). So, housing booms occur after all administration changes (Fernández-Eguiarte *et al.*, 2002). Therefore, there are houses on the Magdalena and Eslava riverbanks (RM06), despite the National Water law specifying that there should not be any construction for at least 10 metres back from the river (Ley de Aguas Nacionales, 2016; RM06; RM09). Nevertheless, no authority enforces the execution of the legislation (RM03). This issue becomes more complicated as the law is vague. This is because it continues changing, and through changes, some gaps open. In this case, RM09 describes that the terms of channels responsibility were modified recently, and the federal protection near the rivers became reduced, from 15 to 10 metres wide (RM09). Hence, there are some zones where no one is responsible, leaving some natural areas with informal settlements, reducing the possibility of evicting those settlements and new ones (RM09).

Also, certain behaviours related to power struggles occur, like corruption and other illegal practices, such as deforestation (RM11), while works and programmes are reported as finished when they are not (RM12 and RM16)

> *The (financial) resource is spent, the work is reported as finished and you go and it is not…The conservation work is not finished even though it was (reported) and the (financial) resource was spent (RM09)*

Financial resource diversion happens at all levels, and this strongly impacted the Magdalena River Restoration Project. Economic resources were distributed for the construction of huts, fire vigilance, care of natural resources, among other conservation projects. However, the group that was in charge of the Magdalena Atlitic, by that time, took everything and left nothing for the community group that took control (RM13). Furthermore, the new representative did not receive the respective budget for the project as they could not prove the previous expenses when the opposing group was in control (Zamora-Sáenz, 2013).

6.3.7 Cultural significance and association of the regime

This project was an opportunity to gain publicity and recognition for some actors, the ones who pushed the project forward. Several prizes were won related to this Master Plan. The Chimalistac-Viveros linear park won a prize of landscape architecture (RM07), and the metropolitan government won the 2001 *Government Leadership Awards for Excellence in City Policy for Green Building* received during the United Nations Climate Change Conference (COP17). This prize recognised the implementation of the Plan Verde, which supported the Magdalena River restoration besides other environmental strategies (SMA-GDF, 2012).

The recognition and prizes validate these type of projects, but according to RM12, hide the real outputs of the 2006-2012 intervention in the Magdalena River, especially to the population that has no direct relationship to this river. Therefore, some participants believe that this publicity was more a political strategy rather than an environmental concern because government representatives can appear in the newspapers promoting projects and actions (RM04; RM09). A pattern of publicity that is repeated in every new administration, but without significant results (RM04; RM11).

> *All the authority attempts (to restore this river) has been just for (showing up) and trying to sell ... that they are concern about the environment…This requires a lot of resources, so the authority does not take it seriously (RM10).*

The community has different perspectives on the river, as for some people it is part of the site, so they are always afraid that any intervention is a plot to take the water away (RM05; RM11). However, the Magdalena River tends to be forgotten unless flooding affects people's homes or infrastructure (Quintero *et al.*, 2009). RM06 recalls that the history of the river and the factories in the area had transformed the relationship of the river with the neighbours, as the local people were related to the river in a utilitarian way and sudden a transition happened when the factories closed. The relation of society with the river abruptly finished. People stopped seeing the river and the basin as something useful, so the river lost importance and now the population even pretend that the river does not exist in the urban area (RM06). In the conservation area that utilitarian vision is maintained, so it is not strange that recreational activities and infrastructure continue spreading upstream, but this is changing the character of the area into a recreational one.

6.3.8 Context

The Magdalena River Restoration Project showed that the context also influences experiments. Social circumstances played a detrimental part in the project, raising political concerns and causing the diminishment of the governmental support towards the project (RM07). The summary of the community rejections and manifestations are shown in Table 6.8.

Table 6.8 Community rejections against the works for the Magdalena River Restoration

Community	Events and manifestations against the restoration project
Magdalena Atlitic	This community stopped the construction works through legal mechanisms. They had the support of a former municipal president that was a member of the parliament (Cruz, 2011; Reforma-Staff, 2007b). Also, this community displayed violent confrontations, such as igniting the heavy machinery in Los Dinamos or pulling out the pipes (LaJornada-Staff, 2010; Montes, 2011; SEDEMA-GDF, 2012; RM05, RM09, RM13).
La Cañada	Neighbours of La Cañada complained about the restoration project, claiming that they did not know about the project until the works started (RM11). La Cañada neighbours sued the Environmental Ministry, but they could not stop the implementation of this drainage, as it is a group that is always ignored (RM05; RM12). The neighbours continued gathering every week for about a year (RM12).
Chimalistac	The neighbours complained because they did not know about the linear park until some trees were cut down in *Paseo del Río* (RM10). They received three different versions of the river restoration project, while the last proposal stated a treatment plant nearby to the neighbourhood, over Miguel Ángel de Quevedo Street and Universidad Avenue (RM10). The neighbours protested against this plant, arguing that treatment plants in Mexico have proven to be poorly managed, especially concerning sludge and odour (Zamora-Sáenz, 2013). The neighbours arranged some meetings with the Mayor and stopped the implementation of these two projects (Montes & Arellano, 2011; Sosa, 2011; RM10).

Most of the social problems emerged due to the insufficient information displayed about the project, except in the Magdalena Atlitic, where problems relate to the internal division of this community. Conflicts and division inside this community evolved from its origins when the community rights were established through poorly defined criteria (Neitzel *et al.*, 2014). This community comprises original settlers and people that arrived later as a result of urbanisation processes. Both groups were recognised as communal landowners[21], but:

> *…this generates fractions from its very origin…because there is a struggle for deciding who is a communal landowner and who is not, and then this is reflected in a political confrontation,… exclusion and divisionism (RM01).*

This division had influenced the decisions taken in the basin that prioritise the advantages that one group can take from programmes or projects, instead of the common good of the whole community and the basin (RM06). Also, this community has been used by political groups as *"sometimes (they are) used as a support or shock group, depending on ... the political dynamics of the municipality*" (RM01). There are many political

[21]The Magdalena Atlitic is a huge community comprised of 1779 right landowners (Almeida-Leñero & García-Juárez, 2009), but the poor internal organisation of this community compromise the decision making and the management of the basin, as they cannot agree and barely can gather the quorum in the official assemblies (RM09).

interests and affiliations inside of this community, and its members tend to be in favour or against the municipality depending on which side is the municipal government (RM04).

> *Who is tendering (to become) the municipal president, talks with the groups and pull them with promises... obviously that creates many divisions (RM05).*

Thereby, the highly politicised Magdalena Atlitic stopped the restoration project, as they are embedded in local political struggles within some incumbent actors, making difficult to separate any project from the political background. However, this socio-political dynamic was dismissed in the Master Plan as it concentrated on the technical issues (RM05). Moreover, this problem increased because of how the project was developed, without creating any mechanism to reincorporate community demands or make the resource allocation impartial and transparent.

Additionally, RM09 emphasises that the project was severely damaged by the information voids that relate to different planning scales in Mexico City, as the Magdalena River Restoration Project was in opposition to other urban projects, like the Southern Arc Motorway.

> *So, (the Southern Arc) is constructed because it is constructed...However,…we are investing in a 20-year project, really huge investment to rescue the last living river in the city… and then we will build something that will destroy the (river) spring...The Southern Arc already has …more years,…about 15 years (RM09).*

A second project, the Orient Super motorway, was designed at the same time as the river restoration (Alfie, 2013). This motorway was constructed a few kilometres away from the river, over the forest that the Master Plan stipulated to protect. Despite this motorway having several problems such as community rejection and a series of legal voids, this project was concluded due to its concession or business character (Alfie, 2013). This antagonism between urban projects displays how sustainable projects are susceptible to contextual variables.

6.3.9 Synthesis

The analysis illustrates how the sub-regime of public policies and political power has a considerable strength over the other sub regimes in the management of the Magdalena River and its basin, as actors influence the regime structure and the social system to maintain power. Financial resources are the tools to maintain such power as money is injected in the area through environmental programmes, which are distributed by different agencies. However, the segregation of these agencies creates diverse and contradicting programmes, which are assigned to different actors while reinforcing *clientelistic* practices. Whilst more money is injected to the area, more power struggles appear within the local community, as shown in Figure 6.7. However, these struggles tend to replicate to the administrative sphere that tends to solve such problems through distributing more grants and projects without a proper plan, as occurred with the Magdalena Project (specific projects) and the Magdalena Atlitic, as described by RM01.

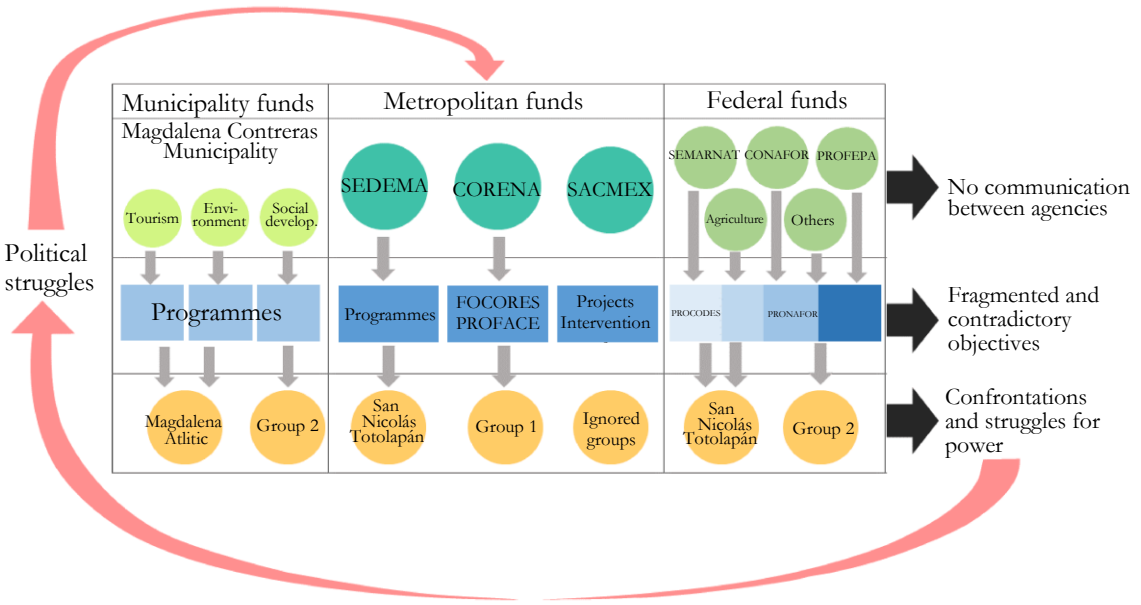

Figure 6.7 The reinforcement of political power in the Magdalena Basin

The three sub regimes that have the main strength in the area are political power (and public policies), the institutional structure and the financial resources. Also, infrastructure plays a fundamental role as most of the interventions, including the restoration project, had a technological approach that altered the natural character of the river while prioritising services over resources conservation. Knowledgebase keeps a fundamental role in maintaining this technological approach, but there is also a considerable unawareness about the site and what has been done before. The cultural significance is based on the utilitarian perspective about the river (water supply), while prizes and recognitions tend to be used to validate sustainable projects, despite whether the intervention reflects the projects‘ design. Landscape pressures have pushed for the introduction of these projects accompanied by public participation. However, participation tends to be highly influenced by political practices, while low standards have restricted real participation practices that are rapidly replaced by *clientelistic* practices. The influence of the seven sub-regimes into the site and the project is shown in Figure 6.8, displaying that these sub-regimes have different influences or power in the Magdalena Basin

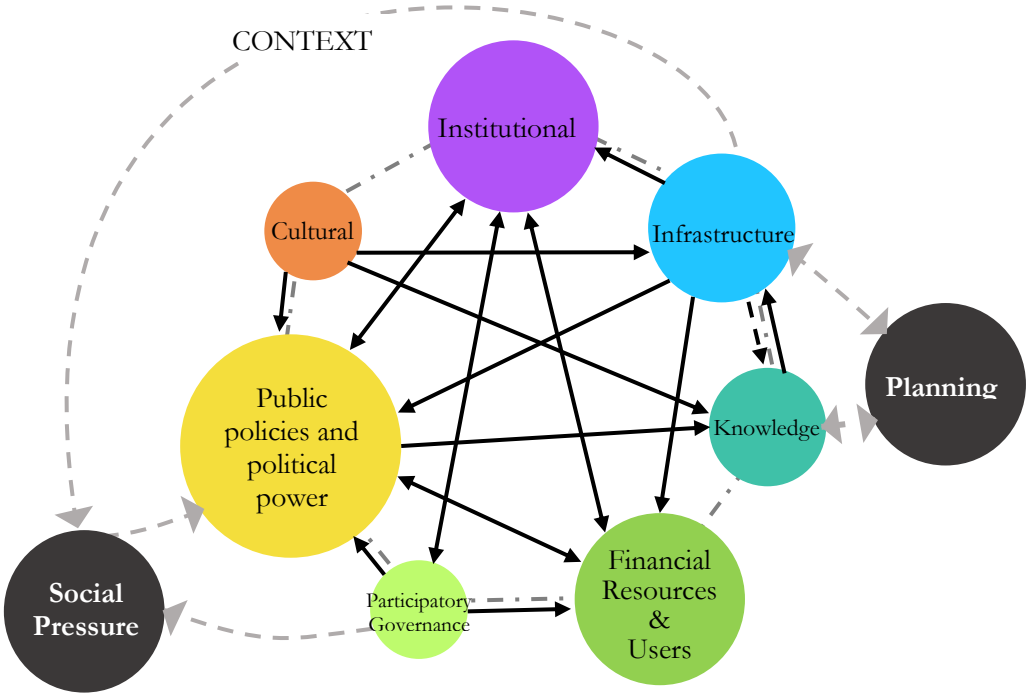

Figure 6.8 The regime in the Magdalena River basin

Figure 6.8 shows how the context played a fundamental role in the dynamics between the regime and the project. Through limited community participation, not even a communication programme to inform the people, and the inadequate infrastructure implementation, the project received a reaction in the community that stopped it. Some groups were able to create political struggles around this project. Also, inadequate urban planning influenced this project, as Mexico City planning has been the result of fragmented proposals, without real knowledge of what other agencies are doing (like the transport system) in the city. Therefore, the Magdalena Restoration Project was implemented in parallel to two other projects that had no relationship to the river, but that have negatively influenced it. These parallel projects restrict the time of the implemented infrastructure, making this project highly vulnerable and rapidly obsolete. Thereby, restoration projects tend to be temporal even besides political periods as they will last until another project is promoted, discharging previous interventions. This represents a high economic and environmental cost for the city.

6.4 Project-Regime Dynamics

The previous sections detail the project and the regime characteristics, but they are not illustrating the variables fully. Figure 6.9 becomes useful to illustrate how incumbents react, changing each dimension of the regime differently as the project evolved. This figure summarises the previous sections while making visible some dynamics that were not evident by looking at the frameworks separately.

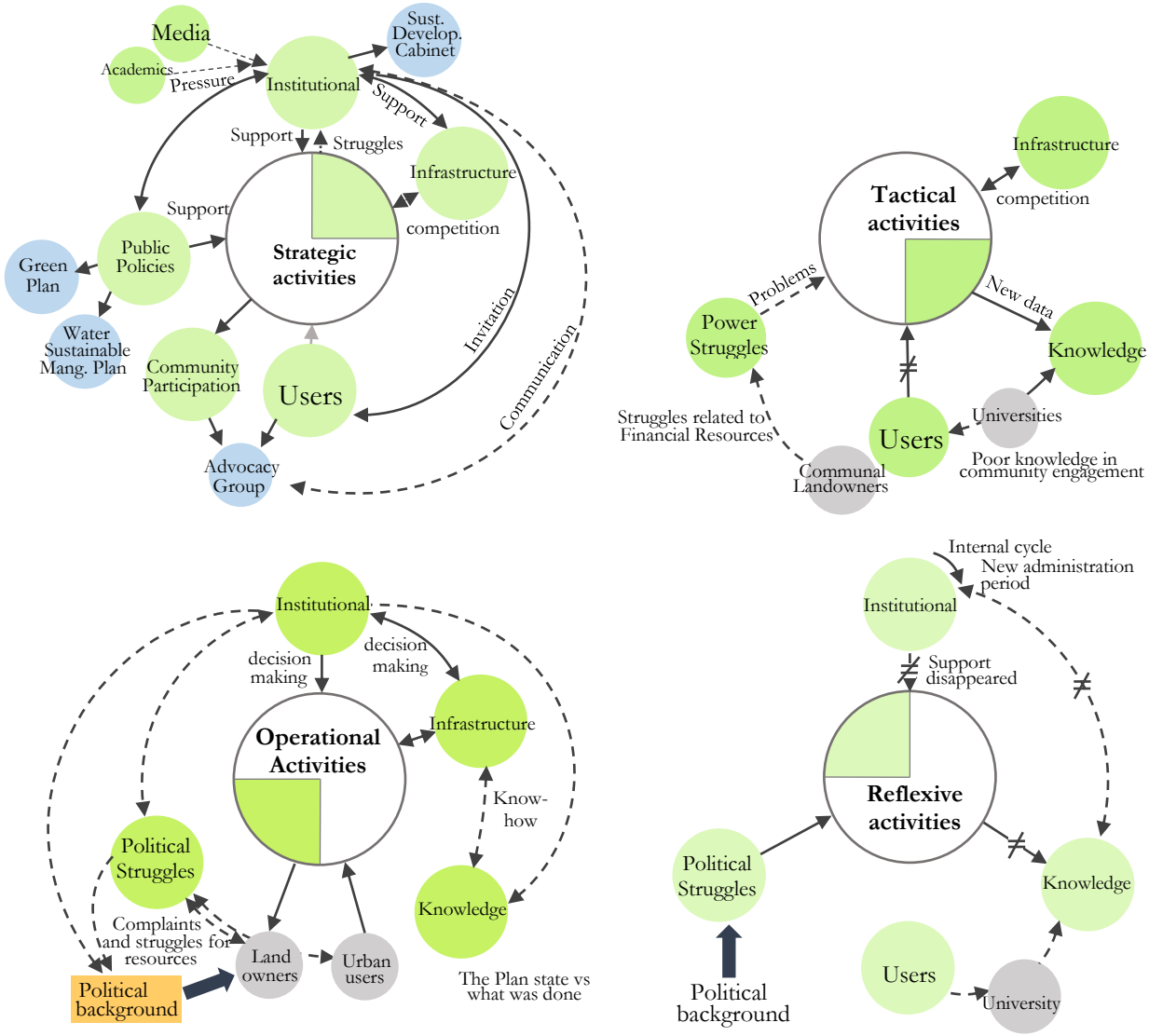

Figure 6.9 Dynamics between the regime and the Magdalena River Project

In the *Strategic Activities,* the diagram shows how incumbents[22] through the institutional dimension reacted towards the external pressures affecting other dimensions. However, the incumbents continue displaying support to the conventional infrastructure (potabilisation plant) that competed with the project. The dotted line reflects the influences that were perceived, such as rumours, but were not evident such as resource distribution. Here, political struggles were recognised in the transition arena or Advocacy Group. This pressure reacted to the institutional domain, where it is decided whether to change the development of the project in order to avoid political conflicts, reducing the participation of the regime and its actors.

[22] The city´s Mayor reacted to external pressures. He can be considered an incumbent as is the responsible for managing the water resources and for delivering the water services, addressesing such responsibilities through SACMEX (Garmendia-Cedillo, 2012: 252).

During the *Tactical Activities*, the institutional structure, as organisations and incumbents, disappeared as the project was delegated to the Universities and the Coordination Group, which had no power (RM07). Whereas, the conventional infrastructure (treatment plant) continued competing with the project. During this stage, the project was generating knowledge about alternative projects and governance, but nobody was receiving such knowledge in the regime while users were disappearing or representing struggles related to power (demanding compensations for allowing the project). Then, the project faced a significant disruption, as the main actors who held knowledge left. Hence, it can be said that the project weakened with the exit of the academics from the project, allowing the incumbent actors (SEDEMA and SACMEX) to take significant decisions about the project. This is clear in Figure 6.9, which shows how the influence of the regime grew back again during the *Operational Activities*. However, the influence can be considered negative, as some incumbent actors took important decisions that debilitated the project (i.e. introducing heavy machinery inside the river). Also, political struggles grew from the community who complained about the works and even stopped the river restoration project, while displaying that some struggles are the result of incumbent political involvement within the social system (before and during the project). The project debilitated (the colour in the diagram fades away) during the *Reflexive Activities* and the relationship between regime and project became broken. Some users (neighbours) keep contact with some academics, maintaining some knowledge about this project while recognising some ideas of how to implement this type of project, displayed in the Natural Protected Area proposal.

This image allows recognition of the intermittent participation of the institutional structure within the project development and how power struggles were present all the time, illustrating how every process of the experiments convey struggles. The users (as a variable) were present during the whole development, but displaying how they become one of the main participants (strategy) to one of the main obstacles of the project, showing that more work is needed to involve the community.

6.5 Summary

This restoration project wanted to re-introduce the Magdalena River as a prominent element of the urban realm, but introducing the river as a vibrant element in the city implies changing the historical dynamics towards the river that have been neglected and denied it. Instead, the restoration project prioritised the physical character of the river, focusing on a technological solution and relegating social and political domains. That happened due to the regime behaviours that prioritised technical solutions but poorly designed the development process. The project became fragmented as there was no link between the three main aspects of it: the technical design, the community involvement and the implementation. The project was subjected to lack of communication between involved actors and strict division of responsibilities among agencies, while works were carried out by actors who were unfamiliar to the project. The project was weak as the result of segmented communication between stakeholders. This was translated into a knowledge void that was fulfilled with the regime´s know-how. Then, the regime

actors took control and developed the project within the regime´s institutional regime logic. Thereby, an alternative project became developed within traditional practices, technology and experience that always prevail in Mexico (large infrastructure and pipes) and barely resembled an integrated approach.

Political and power struggles can be considered the main dynamics that affected the project. This project had a political matter from the beginning due to the political character of the Magdalena Basin. However, it became noticeable that the political interest grew during the project development, reaching the highest point during the implementation when the project became tangible. The political character increased because the project reflected political interests for certain groups, from the community (that it is highly political) and from different members of the government. This political background was poorly considered in the Master Plan, which believed that community involvement as the sole strategy to create public support against political matters. Meanwhile, the policy and the institutional structure were inadequate to balance power struggles.

Chapter seven

7 Project UNESCO-Xochimilco

Xochimilco faces the existence of two contradictory discourses. The first relates to maintaining the character of the area as a UNESCO Heritage Site, while the second prioritises urban water supply at the expense of the natural resources that support the area. Project UNESCO-Xochimilco (PUX) emerged to balance both discourses through a Management Plan. This chapter introduces Xochimilco and Project UNESCO-Xochimilco in Section 7.1. Then, the development of the project is described through the Transition Management in Section 7.2. The *"local"* regime is described through the Socio-Technical Regime model in Section 7.3, recognising the variables that influenced the PUX. In Section 7.4, the dynamics between the project and the regime are described. This chapter ends with a summary of the findings in section 7.5.

7.1 Xochimilco, Tláhuac and the Project of UNESCO

Xochimilco[23] and Tláhuac Municipalities preserve parts of the ancient lake and a traditional agricultural system that depends on surface water (Revollo-Fernández, 2015a). The value of this site has been recognised through several decrees (Collin-Delavaud, 2009; Gonzalez-Pozo *et al.*, 2016; Merlín-Uribe *et al.*, 2013a; Revollo-Fernández, 2015a). The most famous declaration was the introduction of this landscape in *UNESCO´s World Heritage Site* on November 11th, 1987 (Arizaga-Guzman, 2002; PAOT, 2009). Figure 7.1 shows the area that was declared a UNESCO Heritage Site.

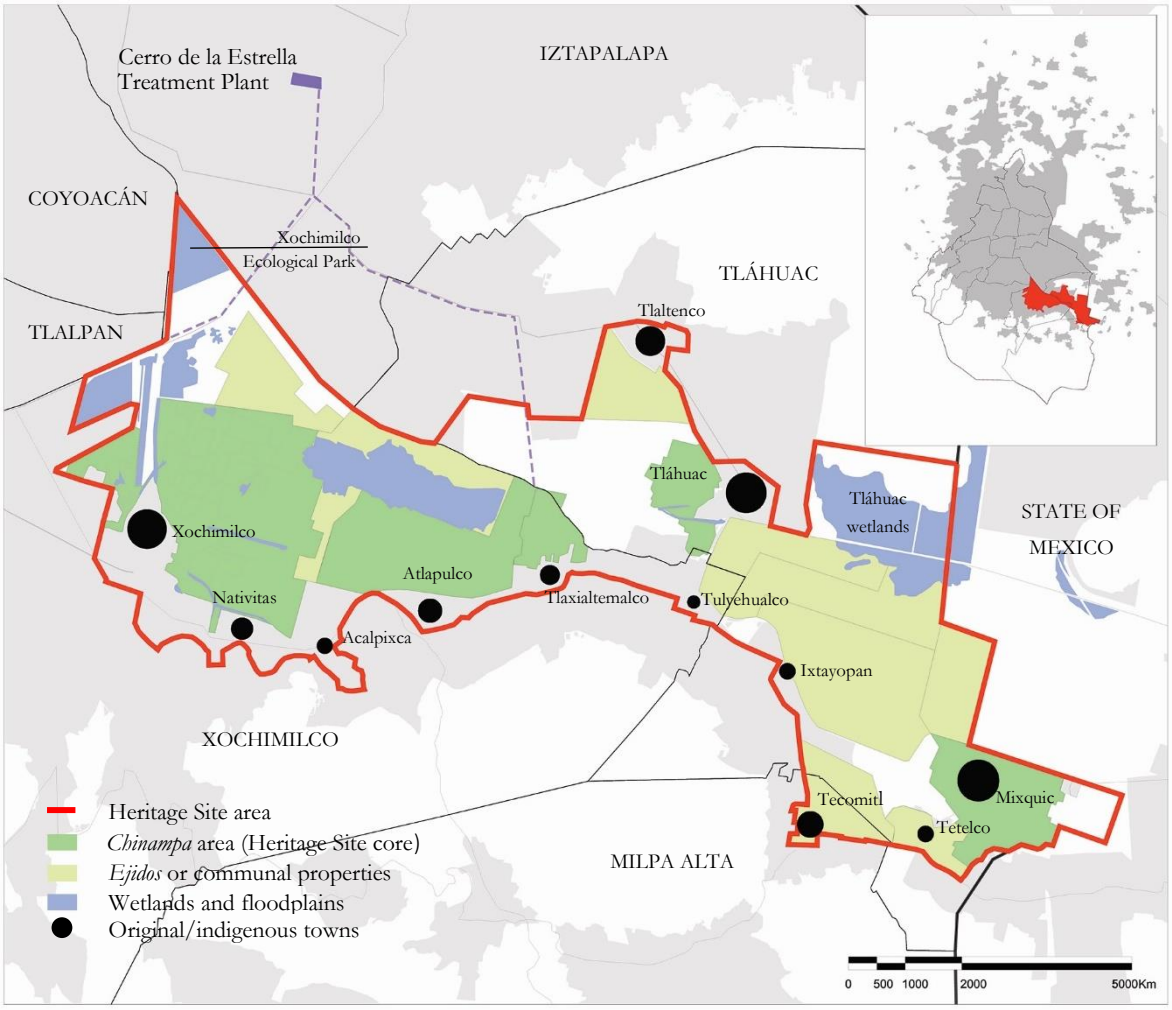

Figure 7.1 UNESCO Heritage site of Xochimilco, Tláhuac and Milpa Alta
based on Caraballo (2006: annexed map) and Gonzalez-Pozo *et al.* (2016: 218).

[23] Xochimilco is the name of the ancient town located in the south of Mexico City. As the city grew, it can be said that this original town evolved until it became an urban neighbourhood or barrio. The name of Xochimilco was also adopted by the municipality.

The introduction of Xochimilco as a World Heritage site lies in the ancestral management of water and the agricultural system that uses the *chinampa* as a production unit (UNESCO-Mexico, 2006d). The *chinampa* is a handmade raised bed created through the vegetal material and mud accumulation, restricted with interlaced willow roots (Stephan-Otto, 1993). It has been described as an artificial island because of its appearance, while allowing water channels between each parcel (Gonzalez-Pozo *et al.*, 2010). This type of agriculture was developed during the 16th Century, and it has endured into the present days (Perez-Montes, Jimenez-Esponda, & Castillo Lopez, 2014). This agriculture method is highly efficient, as it allows more than one harvest per year (Stephan-Otto & Zlotnik-Espinosa, 2001). Figure 7.2 shows the *chinampa* system as a cultural landscape, where the urban area, wetlands and hills integrate a system that allows the *chinampa* culture existence (Caraballo, 2006).

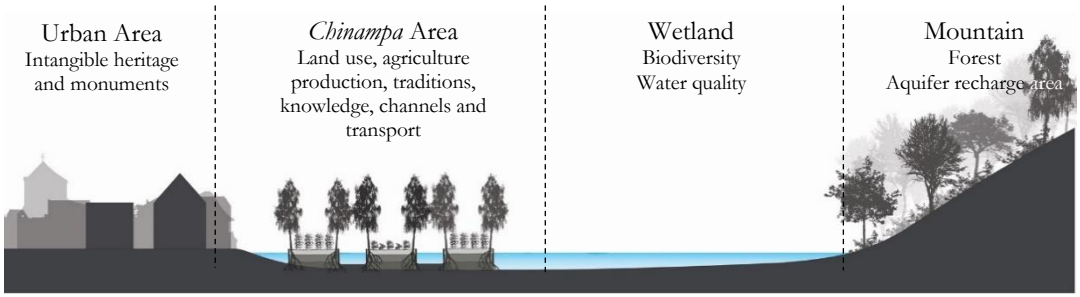

Figure 7.2 Xochimilco's *chinampa* system
based on UNESCO-Mexico (2006c: 24)

The site enlisted by UNESCO comprises 7,530.64 hectares[24] from Xochimilco, Tláhuac and Milpa Alta Municipalities (Caraballo, 2006: 313). Xochimilco and Tláhuac are included in the list because of their wetlands and *chinampas*, while Milpa Alta´s inclusion to this list is due to Tecómitl town (Gonzalez-Pozo *et al.*, 2016). This site comprises 12 original or indigenous towns and nine *ejidos*[25] or communal land properties. There are about 2,215 hectares of *chinampas*, and traditional agriculture occurs in just 19.1% of them. Also, there are 402 kilometres of water channel, but just 42.2% of them are navigable as the rest are dried or obstructed (Gonzalez-Pozo *et al.*, 2016).

At the beginning of the 20th century, significant changes occurred in the area after Xochimilco started to supply water to Mexico City through an aqueduct, and a series of actions were performed to drain Xochimilco and Chalco lakes (Gonzalez-Pozo *et al.*, 2010). Gonzalez-Pozo *et al.* (2016) describe that Xochimilco Lake was drained towards the north into Canal Nacional, while the rivers that used to feed

[24] This research uses the area defined in 2006. At the present time, this area is bigger as the World Heritage Committee approved the addition of three parts into this heritage site in 2014. The new inclusions are: *chinampas* from Amalacachico-Toltenco (including the boating track), the archaeological zone of Cuahilama and another site in Tláhuac lagoon, comprising a final area of 7,534.17 hectares (Gonzalez-Pozo *et al.*, 2016: 21).

[25] The existing nine *ejidos* are: Xochimilco, San Gregorio Atlapulco, Tlaltenco, Tláhuac, Tulyehualco, Iztayopan, Mixquic, Tecómitl and Tetelco (Gonzalez-Pozo *et al.*, 2016).

it (San Lucas and Santiago) were confined as a dam. Tlalmanalco and Amecameca rivers were channelled and diverted towards the north into the main drainage channel, draining Chalco Lake[26].

Xochimilco´s underground water extraction intensified as a measure to restrict Mexico City´s aquifer exploitation and the city subsidence. This condition conveyed to some of Xochimilco´s springs disappearance and the reduction of water levels in the channels (Angeles-Serrano *et al.*, 2008). By 1953, Xochimilco surface water levels reached a critical stage, forcing the government to introduce treated water into the wetlands (Angeles-Serrano *et al.*, 2008; PAOT, 2015). At present, Xochimilco's wetland survives because most of the surface water is supplied from three treatment plants: Cerro de la Estrella supplies one cubic meter per second, San Luis Tlaxialtemalco delivers 0.225 m^3/s, and the water treated in San Lorenzo Tezonco Treatment Plant (Angeles-Serrano *et al.*, 2008; Aréchiga-Córdoba, 2006; Gonzáles & Torres, 2014; PAOT, 2015). However, the management of Cerro de la Estrella treatment plant has been seriously criticised by Ramírez-Guardado *et al.* (2013), because it delivers low-quality water, damaging agriculture. Also, surface water quality considerably reduced after the introduction of the drainage system in the area (the 1930s and 1960-70s) and because informal settlements dispose of domestic waste into the channels (Caraballo, 2006; Merlín-Uribe *et al.*, 2013a; Merlo-Galeazzi & Zambrano, 2014; PAOT, 2015). All these factors, plus the introduction of exotic and invasive flora and fauna, traditional agriculture replacement by greenhouses, subsidence, water quantity shortages[27] and potential floods, among others, contributed to Xochimilco´s degradation and the decline of agricultural activities (Merlo-Galeazzi & Zambrano, 2014; Revollo-Fernández, 2015b; UNESCO-Mexico, 2006c).

Despite that Xochimilco has been declared a UNESCO´s Heritage Site, its degradation continues. Vadi (2014b) points out that the Heritage Site classification does not guarantee the site conservation, because this recognition does not imply the intervention of UNESCO in the site's management or the imposition of a regulatory framework. UNESCO does not enforce regulations or apply sanctions, the only mechanism that UNESCO has to ensure the heritage protection is the introduction of shame in the hosting state if a site is announced as a World Heritage in Danger (Vadi, 2014a). Recently, as a strategy to ensure the Heritage Sites Protection from this legal void, the UNESCO requested a Management Plan for each heritage site listed. As part of this request, the Project UNESCO-Xochimilco was developed (Gonzalez-Pozo *et al.*, 2010) to design a Management Plan that would act as the legal protection defining basic conditions and action lines for the site`s operation while controlling and minimising threats (UNESCO-Mexico, 2006d). This Management Plan would ensure a supporting structure to enable conservation and sustainable programmes in the Heritage site of Xochimilco while guaranteeing economic resources for such programmes (UNESCO-Mexico, 2006b, 2006c).

[26] Tlalmanalco River was converted into La Compañía Channel at the beginning of the 20th century, while the second river became the Amecameca Channel around the 1950s. These events resulted in the complete separation of both lakes and the eventual disappearance of Chalco Lake (Gonzalez-Pozo *et al.*, 2016).

[27] Subsidence caused by underground water over-extraction causes the channels flow to become really slow or inexistent (Caraballo, 2006). Some channels have become unnavigable as they disappeared, or been covered by gravel or aquatic lily (Gonzalez-Pozo *et al.*, 2016).

The Project UNESCO-Xochimilco was designed in three phases. Phase one and two were developed from 2003 to 2005, comprising 82 interviews, one survey and a series of complementing activities, described in Annexe J (p. 297). Phase three comprised the Comprehensive Plan and Management Structure[28], identifying different agencies attributions, as programmes and projects that are needed in the area (UNESCO-Mexico, 2006c, 2006d). According to UNESCO-Mexico, the three results of the third phase were: an Integrated Plan, a Management System and the Heritage Site Polygon proposal.

The results of the PUX

1. Integrated Plan

   The Integrated Plan[29] established a series of action lines, projects and programmes around six main topics while detailing activities for the short, middle and long term. The six development lines were: (1) appropriate water management, (2) competitive and sustainable tourism, (3) appropriation of cultural and natural heritage values by Xochimilco´s community, (4) *chinampa* sustainability, (5) improving and organising the urban structure and accessibility while planning urban growth, and finally, (6) intergovernmental coordination with a long-term integrated vision for the World Heritage Management (UNESCO-Mexico, 2006d).

   In the case of water management, activities were proposed with the collaboration of governmental agencies and the community. The encompassing activities were related to water quality enhancement, through producing treated water, eliminating illegal discharges and the use of chemicals for agriculture. Moreover, the plan states water quality conservation, through monitoring floods and subsidence, restoring channels, exploiting groundwater rationally and improving aquifer recharge in the mountain zones (UNESCO-Mexico, 2006d). SACMEX was involved and participated in the Management Plant elaboration and committed to improving the quality of water in the *chinampa* area avoiding pollution, controlling water levels, increasing treated water and developing studies, projects and works (Alonso-Navarrete, 2004). The main activities in water management are shown in Table 7.1.

[28] *Plan Integral y Estructura de Gestión del Polígono de Xochimilco, Tláhuac y Milpa Alta, inscrito en la lista del Patrimonio Mundial de la UNESCO*

[29] This plan was based on the Management Plan for the Natural Protected Area of Xochimilco y San Gregorio Atlapulco *ejidos* (UNESCO-Mexico, 2006b).

Table 7.1 Activities related to water management
Source: UNESCO-Mexico (2006d)

	Activities for adequate Water Management in Xochimilco as a World Heritage Site
1	Efficient production of treated wastewater
2	Reduce non-native species population
3	Eliminate wastewater discharges into channels
4	Control use of agrochemicals and manure for agriculture
5	Treated wastewater knowledge about benefits and costs
6	Channels and water bodies recovery as part of the World Heritage site system
7	Water levels conservation, monitoring of subsidence and floods
8	Groundwater and surface water rational use
9	Increase aquifer recharge by infiltration
10	Soil erosion control in the basin
11	Local actions decisions that correspond to water problems as a base for the site´s conservation and productivity (e.g. apply regulation related to wastewater discharges and land use)

2. Management System

This system was a key factor for the management and conservation of the heritage site, as it would facilitate intergovernmental coordination, communication between agencies and social actors, and comprehensive policy implementation to protect the urban, cultural and environmental heritage (UNESCO-Mexico, 2006d). This Management System stated a new structure comprising the following four bodies: Management Unit, Technical Council, Executive Committees and a Trust (financial body), plus the constant supervision and participation of the Civil Society and the Academic Body of Technical Advisors (researches and international organisations). This system is represented in Figure 7.3.

The Technical Council for the Site's Management and Development would be the core structure of this system, as it would be the organism capable of decision making, establishing priorities about public policy, projects, financial resources, monitoring and evaluation (Caraballo, 2006). The Management Unit[30] would be responsible for coordinating and managing the execution of Technical Council decisions. This administration body would facilitate activities cooperation, mitigate tensions and maintain the information flowing among all the actors (Caraballo, 2006). It would supervise the site´s administrative and management processes, through applying indicators and instruments to monitor the Management Plan. Also, it would inform the Committees about technical issues and the Council on political decision impacts while engaging the community through Participatory Planning Circles (Caraballo, 2006; Caraballo Perichi, 2007).

[30] The Management Unit was considered to be independent of any political party, separating its members working periods from the political/electoral ones (PUX02 and PUX06).

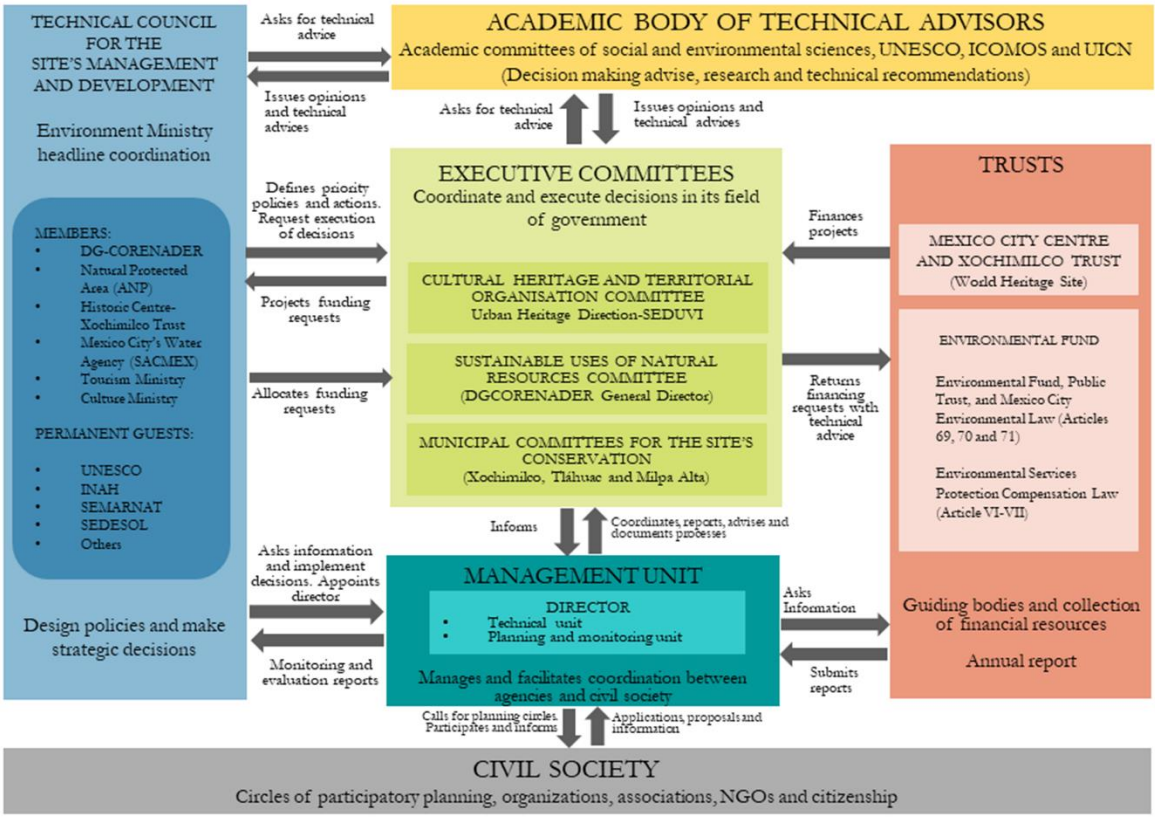

Figure 7.3. Management System Proposal.
Translated from Caraballo (2006: 337)

Two Executive Committees would execute the agreed decisions, evaluate projects and manage development programmes. The Committee of Cultural Heritage and Territorial Order would be oriented to social issues such as the cultural heritage, education, values appropriation, urban order, accessibility and tourism. The Committee on Natural Resources Sustainable Use would be responsible for affairs related to water management, *chinampas* rehabilitation, agricultural support, conservation and protection of natural land and biodiversity (Caraballo, 2006). Finally, the Trust would emerge from the readjustment of two existing bodies: Mexico City Centre (and Xochimilco) Trust and the Environmental Trust, allowing the channelling of financial resources efficiently and with transparency to develop the agreed works (Caraballo, 2006; UNESCO-Mexico, 2006d).

3. Heritage Site area

The Heritage Site was not defined in Xochimilco´s proposal submitted to UNESCO in 1987 (Collin-Delavaud, 2009). The plan considered which sites that lost their exceptional value should be removed from the Heritage Site to avoid legal and management problems (Caraballo, 2006). In this process, the Heritage Site´s area grew, including adjacent wetlands in Tláhuac and one site in Milpa Alta. The new Heritage Site area was set through defining three different zones: (1)

Core Zones of Heritage Preservation, (2) Heritage Recovery Potential Zones, and (3) Permanent Buffer Zone, as shown in Figure 7.4.

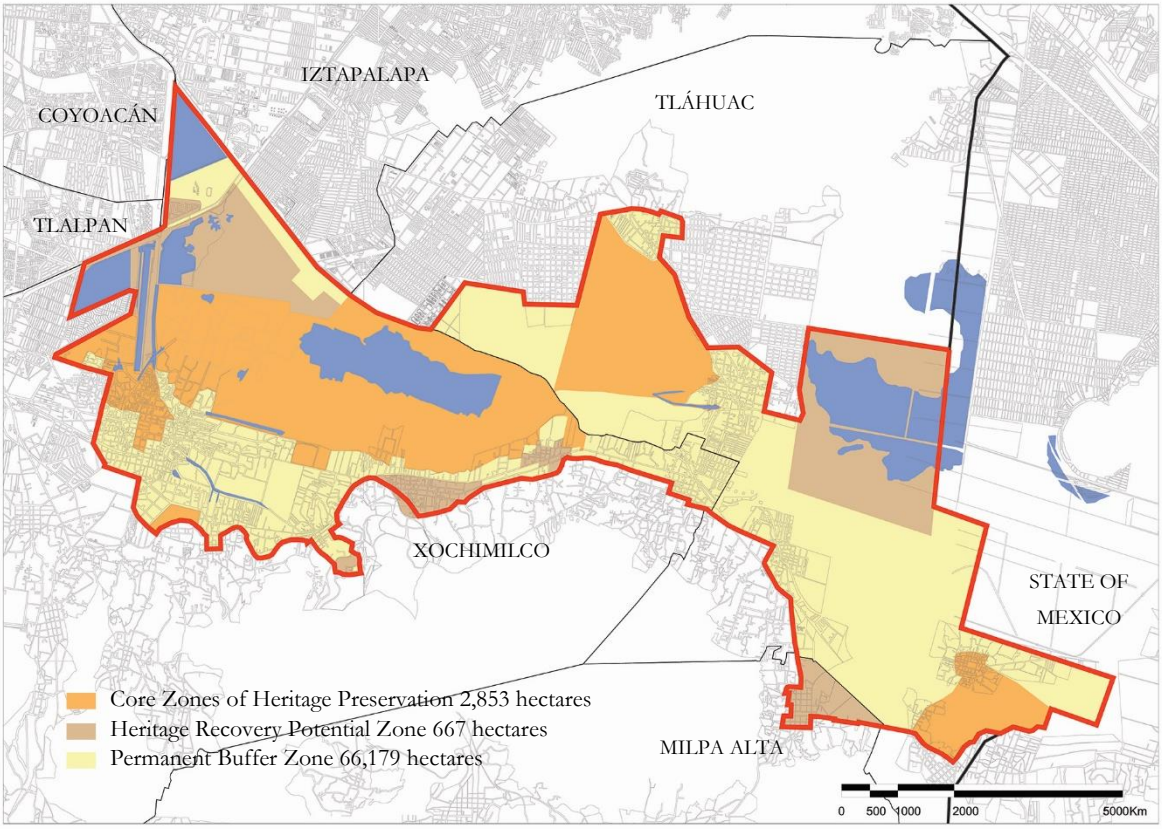

Figure 7.4. World Heritage Site of Xochimilco, Tláhuac and Milpa Alta
Image copied from: Caraballo (2006: annexed map) and legend information from UNESCO-Mexico (2006a: ii).

Priority zones were defined as Core Zones and comprised mostly of wetlands where agricultural production persists. The five main core areas with *chinampas* are located in San Gregorio Atlapulco (484.2ha), Xochimilco (1059.5ha), San Luis Tlaxialtemalco (103.1ha), Tláhuac (164.4ha) and Mixquic (404.3ha) (Gonzalez-Pozo *et al.*, 2016: 218). Recovery Potential Zones are valuable yet severely damaged, but they may be included back in the core zones after rehabilitation and evaluation (Caraballo, 2006). A Permanent Buffer Zone was established to absorb negative influences from external factors (Caraballo, 2006). An influence zone was proposed as the area where possible threats could arise, affecting the site. Cerro de la Estrella treatment plant (that treats water from the Churubusco River) was considered here because if the plant stops, it could generate serious difficulties into the site (Caraballo, 2006).

7.2 Project development

The Project UNESCO-Xochimilco had a broader scope than the Magdalena River Restoration. The PUX was considerably more extensive as its primary goal was the heritage conservation of a site. Therefore, it was a more comprehensive project involving conservation of agriculture and sustainable

tourism, among other elements. *"Water management was only a part, although central to the project"* (PUX03). Hence, it was a project that, in its broader scope, included an IUWM approach. Still, the activities of this project can be defined using the Transition Management activities, which are described in the following section.

7.2.1 Project UNESCO-Xochimilco and Transition Arena conformation

Everything started when a rumour emerged about Xochimilco passing to UNESCO´s List of World Heritage being at risk (Duran, 2003; PUX02, PUX05; PUX12). This event produced a series of mobilisations of neighbours that collected signatures, photographs and documentation while demanding the intervention of UNESCO to stop Xochimilco's degradation (Caraballo, 2006; PUX10).

> *About three years, I knocked doors...I went to UNESCO (Mexico) office…but they did not answer …The municipal president did not pay attention…and I realised that I was not going further. In 1999, I went to (UNESCO) Paris… I submitted some documents and photographs…showing the situation…of Xochimilco... to the representative at that time*[31] *(PUX10).*

This pressure on UNESCO was evident in 2001 when the information presented by the neighbours was supported by reports sent by the Mexican government to UNESCO (Caraballo, 2006). In 2002, Xochimilco´s Municipal President required the support of UNESCO-Mexico to generate an action plan for this World Heritage Site (PUX01).

These events resulted in an observation mission by Dora Arizaga-Guzman (International Council on Monuments and Sites or ICOMOS) and a Forum in Xochimilco in November 2002 (Caraballo, 2006). In the end, UNESCO decided to have more active participation in the site and started *Xochimilco´s Master Plan for the Integral Rehabilitation of the Historical Centre and the chinampa zone*[32] (Caraballo, 2006), with the support of Xochimilco Municipality and Mexico City government (PUX02). The Project UNESCO-Xochimilco (PUX) was approved in the UNESCO's World Heritage Committee (WHC) 27th session, when the committee supported the Mexican Government in introducing a comprehensive Master Plan and related management strategies, as reviewing the site´s physical limits (UNESCO-Mexico, 2006b).

The Project UNESCO-Xochimilco (PUX) officially started after signing the *Inter-institutional Agreement on Technical Cooperation for the Social Sustainability of the Cultural Heritage Site of Xochimilco* on June 2nd, 2003[33] (Duran, 2003). From that moment, the Transition Arena was comprised when Xochimilco Municipality and UNESCO-Mexico engaged in the design of a management plan. The UNESCO put together a multidisciplinary team (PUX team) comprised of archaeologists, biologists, sociologists and anthropologists, among other experts. They were hired by Xochimilco Municipality (PUX03; PUX06) and would be working in parallel with UNESCO (PUX05). The project was carried out by Ciro Caraballo

[31] PUX10 also recalls that she visited for a second time UNESCO offices in Paris, the UNOG in Geneva, Switzerland and the UN in New York.

[32] *Plan Maestro de Rehabilitación Integral del centro histórico y la zona chinampera de Xochimilco*.

[33] *Convenio Interinstitucional de Cooperación Técnica para la Sostenibilidad Social del Patrimonio Cultural de la Humanidad de Xochimilco*

(coordinator) who organised this team and who was a central actor, as he created a positive dynamic and acceptance from different actors (PUX01, PUX03, PUX06; PUX12). This group worked in the management plan, contacting key people from the communities and agencies (PUX03, PUX06), collecting and reconciling the existing information about the site since 1987, when the site had been included in the World Heritage List (Duran, 2003; PUX03; PUX04). The *strategic activities* were developed, as shown in Table 7.2.

Table 7.2 Strategic Activities for the PUX

Activity	Concepts and ideas	Description
Vision Development	Management Plan	Guidance of principles and space to achieve agreements
Strategic Discussions	Management process	The participatory design of this Plan was the beginning of the Management Process. This plan would trigger further commitments towards the conservation and the negotiations that should endure between all the stakeholders in the following stages.
Long-Term Goal Formulation	Xochimilco Conservation (as a system)	The conservation of this site, maintaining its inclusion in the UNESCO'S Heritage list
Collective Goal and Norm Setting	The objective vision of Xochimilco as a Cultural Landscape	Sustainable and integrated management of interlinked natural and cultural resources (Holistic Heritage)
	Reference Terms	The statement of the main goals to be achieved in the process, guided by the PUX team
	The state is responsible for maintaining the heritage site.	The state reinforced its commitment through supporting the creation of the multidisciplinary team (PUX), the Natural Heritage Conservation Fund and installing an office on site.
Debates on Norms and Values	High interest versus the low interest of the community in maintaining the site	
	Community is losing their identity with the *chinampa* culture	
	High distrust towards authorities and high expectation on international agencies (UNESCO).	
	The implementation of a System of Indicators (Monitoring and evaluation)	
	The creation of broader benefits (sustainable outcomes)	

Vision development

Project UNESCO-Xochimilco was created to generate a Management Plan for Xochimilco as a world heritage site, ensuring the conservation of it, controlling threats and guiding the change processes on the site (UNESCO-Mexico, 2006d). This Management Plan was defined as *"a guide of basic management principles and the space to achieve agreements between authorities, citizens and users in the short, medium and long term"* (UNESCO-Mexico, 2006d: 11). The idea was to design a plan that could be studied and evaluated on-site while having the population and the municipal president's approval (PUX02 PUX03, PUX04; PUX06).

Strategic Discussions

This plan evolved from the experience that UNESCO already had (Caraballo, 2006), which recognised the fundamental role of local communities in maintaining *living cultural landscapes*, such as Xochimilco (Caraballo, 2006; PUX02; PUX05). In this case, the core of the UNESCO declaration is the *chinampa,* and it had to be preserved to maintain the declaration while people must keep cultivating them (UNESCO-Mexico, 2006d; PUX02; PUX11). Hence, the Participatory Management Plan was the

beginning of a process where the community embrace the management concepts through the design process, making it a more active actor in the management of Xochimilco (PUX06). Therefore,

> *The elaboration of the Management Plan is not the end of the process; it is the beginning of it (UNESCO-Mexico, 2006d: 11).*

This idea is that the process of dialogue and decision making starts with the plan design and continues in the future, deciding what to do and how to do it. This plan should be the result of all concerns and strategies, translated into a document with a territorial impact (PUX05).

Long-Term Goal Formulation

The goal was the conservation of the site and the values that make Xochimilco a world heritage site, emphasising the integrated conservation because the Heritage Site is a system: the *chinampa* system. Hence, it is essential to conserve each of the elements that maintain this system (Caraballo, 2006; PUX02).

Collective Goal and Norm Setting

This goal emerged from a collective vision of the desired future for Xochimilco (UNESCO-Mexico, 2006c) that required the local people to be involved in the discussion, while becoming active agents in the management of Xochimilco (PUX06). Here:

> *Heritage and cultural landscapes have …many elements that have to do with…people …that is a…broad process that includes almost everything that is done in this area (PUX06).*

Cultural landscape recognises the interlinked relation of nature in the works of humankind (Caraballo, 2006). Heritage intersects several domains, so to improve the conditions of a heritage site involves the improvement of other domains (PUX06). The Management Plan needed to address several problems at the same time, becoming a holistic matter (Caraballo, 2006; PUX17).

> *An investment in cultural heritage…would have repercussions in many other fields that we would not call cultural heritage. So, creating these (conceptual) links and creating this vision was…the goal of the project… (PUX06)*

Several factors affect the *chinampas* existence, like illegal urbanisation and the domestic discharges in the channels, among others (PUX01). Water management represents a significant problem in the zone, and thereby, the conditions of the water system need to improve, as Xochimilco without water will lose its heritage values (PUX06; PUX11). Thus, it was necessary to work in several aspects of the system, such as improving drainage, controlling illegal domestic discharges, increasing the amount of treated water, infiltrating rainwater into the subsoil and recharging the aquifer, among other tasks (PUX11, PUX17). The improvement of water management in the area had to overlap into other domains (e.g. forest management and urbanisation), as everything intersects (PUX01; PUX06). However, most of the

previous attempts that aimed to slow down the site's degradation were small and isolated actions that resulted in limited and temporal results (Caraballo, 2006). Hence, the necessity of collaborative, inter-disciplinary and integrated work (Caraballo, 2006; PUX03; PUX17).

The PUX worked according to *Reference Terms* that outlined the main goals to be achieved in the process (PUX04). Additionally, the main driver pushing this project is the inclusion of Xochimilco in the UNESCO Heritage Site, which laid the responsibility of conserving the site to the host state (UNESCO-Mexico, 2006d).

> *When Mexico signed the Heritage Convention in 1972, it forced the Mexican state… to transmit the ancestral knowledge to the following generations (PUX09).*

The Mexican government formalised its commitment to support this project by creating the *Cultural and Natural Heritage Conservation Fund* to guarantee financial resources into the project (Caraballo, 2006), and thereby, UNESCO´s participation was granted. Additionally,

> *They gave (to the PUX) a small space (office)…in a key place because it was the centre of Xochimilco…it made us visible with a logo and then (people) knew that the UN through the UNESCO was collaborating with the municipality (PUX02).*

Debates on Norms and Values

A joint agreement was necessary for saving Xochimilco´s heritage character and stopping its rapid deterioration, but not everybody agreed the way of doing it (PUX02, PUX09, PUX10; PUX13). The most controversial debate was around the willingness of the people to maintain the character of Xochimilco and what were they willing to do to conserve it. Two perceptions of the population contradict each other in regards to maintaining the site. PUX04 and PUX12 believe that the local people are very interested in maintaining the site and their heritage. However, there is also a considerable part of the population that is not interested in maintaining its character (PUX10). They want the *chinampas* and channels to disappear (PUX09). This tendency escalated because it is becoming more challenging to preserve the site, as the identity with the *chinampas* was getting lost. That means fewer people were working in the *chinampas*.

> *Many people, older people inherited (land) to their children, but the children as they studied, they do not want to work it and have sold their land (PUX10)*

PUX17 suggests that there is still something calling the people to work the land because it is part of their heritage, so they returned to working it on at weekends. However, traditional agricultural is getting lost (Gobierno de la Ciudad de México, 2015).

The community do not trust the government structures (PUX09, PUX08; PUX10), making the implementation of projects that come from the governmental sphere complicated (PUX04; PUX12). The intervention of UNESCO seemed to increase the trust of the population into this venture, but some

participants mention that UNESCO involvement caused false expectations in the community, like UNESCO was injecting money and doing everything (PUX02, PUX03, PUX08; PUX09).

A System of Indicators was mentioned as necessary for monitoring and evaluation. This would follow the Management plan development and study the conservation of the values of this site (Caraballo Perichi, 2007). The indicators would measure the community perception about values of the heritage site, the impacts of programmes and plans, and the relation between site´s conservation with social and economic development factors, or the social use of natural resources (Caraballo Perichi, 2007; UNESCO-Mexico, 2006c).

Also, not all the people in the city were aware of the benefits that could come from Xochimilco nor the risk of losing it (Natoure, 2016). However, Xochimilco conservation can bring further benefits that intersect with sustainability

> *One, it is a system that is producing food… the fact that here we can produce what we consume, or at least part of it, is a point towards having a better quality of life… (PUX11).*

7.2.2 Visioning: The Master Plan Design

In September 2003, UNESCO and Xochimilco Municipality signed the agreement to develop a *Participatory Identification Study for the Comprehensive Rehabilitation Plan for the Heritage Site* (UNESCO-Mexico, 2006b), and the Management Plan was designed through a series of activities described in Table 7.3.

Table 7.3 Tactical Strategies for the PUX

Activity	Sub-Activity/Participants	
Defining activities for future experiments	Technical diagnosis	The PUX team gathered the existing information of the site
	Working with communities	Social Communication Strategy, a survey, a participatory diagnosis, community participation workshops and workshops with farmers. Work developed by the PUX team
	Workshops with Agencies	Priority Action Workshops, SIRCHAL and Logical Framework Workshops. Developed by the PUX team
New patterns and structures (rules and regulations, institutions, organisations and networks, infrastructure, and routines)	Meetings and workshops	Some meetings with the agencies intended to be the first step to consolidate a Management Unit (Interinstitutional Commission), a transition step to a steering activity or experiment
Involved stakeholders, networks and coalitions	PUX team, community, members of academia and agencies (local, metropolitan and federal)	PUX was the link between different stakeholders. Members from agencies/government that need to be involved in the Management System

Defining activities for future experiments

The main activities were developed during designing the Management Plan, gathering the perspective and knowledge of the local community, academics and agencies members (UNESCO-Mexico, 2006d). The PUX team carried a technical diagnosis with the existing information about this site, analysing, discussing and integrating it into other topics (PUX11). Here, many agencies, universities (UNAM, UAM

and IPN) and many other actors were working with that idea of contributing to solving Xochimilco´s problems (PUX04). The information gathered was complemented with data from workshops and activities developed with the local community and members of agencies.

Working with communities

Community participation was a fundamental part of this Management Plan, and a series of activities were designed to achieve community involvement. This work started with a *Social Communication Strategy* that involved school visits and community meetings, where the PUX created consciousness about the value of the environment in the population and emphasised that teamwork (UNESCO, government and community) was essential to restore Xochimilco (PUX09; PUX10).

> *Ciro Caraballo with his group…went to houses…walked in the streets and announced the benefits of the project. That UNESCO was not going to do everything, but us the chinampa owners. (They said:) "Take care of your surroundings, as before you did …you embellished your chinampas" (PUX09).*

This strategy had three main goals: (a) publicise the project, (b) raise awareness in the local population about Xochimilco´s problems and their responsibility in maintaining this site, and (c) explain the real role of UNESCO in this process. The PUX team specified that this project was funded by Xochimilco Municipality and "*that any action would be undertaken by the governments and not by UNESCO*" (PUX03). This process aimed to erased preconceptions that people had about the UNESCO and stopped the rumour that this international agency was financing the project.

Also, a survey about people´s perception or *Values and Representations of the Cultural Heritage in Xochimilco* was developed to identify the social values associated with the heritage and trace the perception of the local population (UNESCO-Mexico, 2006d). Then, a Participatory Diagnosis was elaborated to recognise priorities (Caraballo, 2006). This diagnosis was done based on meetings with the community and with authorities. During that process, the PUX team looked for people who had already worked in the area, researchers and NGOs, gathering viewpoints of the people involved in the area (PUX02).

Then, 27 community participation workshops were developed (UNESCO-Mexico, 2006a, 2006b). These workshops used the Prospective Planning Technique, which according to PUX03, is a technique used in the resolution of personal conflicts and problems that people experience daily. Participants defined the site's problems from their point of view, possible solutions and future scenarios (PUX03; PUX11). They also recognised solutions in which they can produce a change as individuals and as a community, then how they think that the municipal and metropolitan governments can contribute to solving such problems (PUX03). This information was analysed and integrated the Management Plan (PUX11).

> *The workshop…gathered all the feelings of the population. That was the essence, the participation…process (PUX16).*

A strong consideration was given to farmers of the *chinampa* area, *ejidos*, and the towns with the largest number of *chinampas*: San Luis Tlaxialtemalco and San Gregorio Atlapulco (PUX03). PUX09 recalls that

he met the PUX team and representatives of the five *chinampa* towns in a meeting. At that moment, he was invited to participate in the workshops and asked to help recruit more participants. About five workshops were developed focusing on the theme of agriculture (PUX03).

Workshops with Agencies

Eventually, the PUX invited agencies members to participate in these workshops. PUX03 describes that this move was because it was evident that some agencies (SEDEMA, CORENA, the municipality, etc.) have to do something concerning Xochimilco problems and they needed to know what people said in the previous workshops (PUX03). Hence, 275 meetings and workshops were held with government agencies and members of the federal and local government (Caraballo, 2006; UNESCO-Mexico, 2006d; PUX03; PUX04), plus individuals and social groups (fishermen, neighbours, people that provide tourism services, etc.) that have been participated since 2003 and expressed their interest in continuing to participate (PUX11). These workshops were defined as *Priority Actions Workshops* because they focused on the main problems while generating essential information, such as the detailed viable solutions and estimated costs, displaying the agencies´ commitments to achieve such proposals (PUX02, PUX03). These workshops were conducted in roundtables around the main action lines (water, tourism, agriculture-*chinampas* and urban order) while geo-positioning such actions (PUX03). These workshops generated opportunities for members of agencies to interact with each other and exchange experiences, facilitating the communication channels, coordination and creating many links between different agencies that did not exist before (PUX03; PUX06). They gave certain direction to the agencies that worked in the area and participated in the Management Plan (RM02), while validating the information and unravelling matters that were not obvious to the PUX team (PUX04). Some of the interviewees were pleased with the results of these workshops. A considerable number of participants accepted and engaged with the ideas that were included throughout the project (PUX03, PUX06).

> *Those of the Water System…liked the idea of being in the centre of attention…linking the water …with the other themes that we had. It was possible to create links between the different government agencies, which is important for the operation of any type of plan (PUX06)*

One of the most significant workshops was the *International Seminar on the Revitalisation of Historic Centres of Latin America and the Caribbean*, better known as SIRCHAL, which was organised by advisors of the Ministry of Culture of France in November 2004 (UNESCO, 2006; PUX03; PUX14). This seminar was held because it was requested by the academics involved in previous workshops (PUX12). The particularity of this workshop is that it was held during a week, and the participants had to work intensively to finish each of the days with concrete results supported with data. That means having viable proposals or programmes that could be implemented in the heritage zone (PUX12; PUX14). Each day started with a presentation, followed by a series of activities, such as developing a brainstorm of ideas, listing the most prominent problems in a hierarchised manner and setting themes (PUX12).

PUX14 recalls that each day, the seminar closed with a presentation to the municipal president about the day's work and the findings gathered. On the last day, final results were presented in the theatre Carlos Pellicer (PUX09). Here, two essential outcomes emerged: (1) water was assumed as the central axis of Xochimilco's problems (Caraballo, 2006) and (2) the agencies´ coordination study, which proposed a dynamic and horizontal administration process based on the interactions of agencies. Leo Orellana (SIRCHAL coordinator) saw this coordination study and approved it. That was the beginning of the new Management Unit (more precisely *Interinstitutional Commission,* PUX03), which was later consolidated as a *Steering Activity*.

A series of workshops emerged to define the area of the Heritage Site. This was part of the commitment in front to WHC (UNESCO-Mexico, 2006b) and the result of geo-positioning the actions in the site (PUX03). This resulted in a much bigger heritage area, including some areas in the neighbouring municipalities of Tláhuac and Milpa Alta (PUX02), the increment of actors from such municipalities and other variables that should have been taken into account in the design of the Management Plan.

During a second stage, the results (prospective scenarios and action lines) of the *Priority Actions Workshops* were gathered and analysed using the *Logical Framework Approach* to develop programmes plans and follow up mechanisms (Caraballo, 2006; PUX 14). The PUX team visited different agencies, working with the logical framework to land all the information into the Management Plan (PUX14). PUX12 describes that the activities developed for this particular framework were the same activities developed in the previous workshops, which make him doubt the usefulness of this type of workshop. During this stage, the project presented some problems. PUX05 mentions that there were problems inside the PUX team. Whereas PUX12, who participated in a *Logical Framework Approach* session, describes that the people leading this sub-project were not engaging with the community, contrary to what Ciro Caraballo (the PUX leader) was achieving. This participant also describes that the coordinators of the *Logical Framework Workshops* were even rude with some *chinampa* landowners, who eventually left some meetings without any interest in continuing to participate.

> *In this meeting... the logical framework, those who coordinated that meeting did not have the least respect for the participants, specifically the population… ejido and chinampa owners… The behaviour was terrible, then the people…did not… participate, many of them left…. That day …there was a position of (those of UNESCO) "I am the doctor…I am the one who makes the decisions here" (PUX12).*

PUX07 describes that the community felt they came to teach them about Xochimilco without really knowing the area, a feeling that increased as some members of the PUX team were foreigners.

Additionally, two factors were affecting the development of the PUX: the vast number of political actors and the political/electoral changes. The PUX was a complex project that required to work with a considerable number of stakeholders and all of them from different political backgrounds (PUX02). However, the process of gathering different agencies' members to participate in this process was more complicated than was expected, as they belong to different political affiliations, which required more

time (PUX02). They could achieve this until late 2005 (PUX02; PUX03), but by that time, the political cycle was already affecting the project

> *…because it was already the end of that administration of the Federal District government and…the end of the municipality administration. All the actors were in the logic of progressive vision, looking for future positions (PUX03).*

Also, the municipality was displaying certain political behaviours. According to PUX04, Xochimilco Municipal President defended his political position in the workshops, and it was evident when the municipality entered to take delicate decisions, *"... delaying things or diluting them....and when there was a political interest... they gave all the support".*

New patterns and structures

Some meetings were transferred into a more established structure, the *Interinstitutional Commission,* which was further developed as a *Steering Activity*, as an experiment aiming to introduce a change in the site governance. Besides this commission, there was no other pattern, activity or institution that became stronger. The PUX team pushed these meetings as part of this project progression; they did not emerge from an organic process that evolved from the activities.

Involved stakeholders, networks and coalitions

These activities involved a considerable number of participants, many government members from Xochimilco Municipality and the Federal District; agency directors from SACMEX, SEDEMA, CONAGUA, SEMARNAT, CORENA, PAOT among others; plus social actors, such as organised groups active neighbours, the clergy; and academics from different institutions (PUX02; PUX03; PUX04; PUX11; PUX 12; PUX14). Also, as the Heritage Area grew, more actors were involved in these activities, as the representatives from the local government of Tláhuac and Milpa Alta municipalities (PUX03). However, the whole recruiting process was not easy, as the process of contacting all these actors required a long time. PUX03 recalls that he felt that things started to flow when a new and interim Mayor of the city (Alejandro Encinas) arrived:

> *He was very interested… even put a special team of his advisors…working in the project. (He) was interested in the coordination of the three municipalities around the management of an extensive area… (PUX03).*

The PUX developed some workshops and other meetings, but there were no significant networks or collisions comprised in this stage, besides the ones that later comprised the *Interinstitutional Commission*. Despite Xochimilco Municipality being the dominant agency interested in this project, it did not delegate a fixed representative to deal with the PUX. It designated some actors to deal with specific matters, but no one from the municipality was constant in the PUX (PUX04). It seems that the municipal president did not give the required importance to this project.

At the end of these workshops, it became evident that community participation diminished as it was relegated under the participation of actors with decision making power. This was due to the consolidation of the *Interinstitutional Commission* and limited communication management during the *Logical Framework seminars*. PUX12, recalls that the participation was somehow biased, as most of the participants, at least 50% of those actors that participated in the SIRCHAL seminar, were people from Xochimilco municipality. This factor generates doubt about the significance of doing these workshops when most of the participants involved have a temporal role in Xochimilco (see Section 7.3.1).

7.2.3 Steering process: the implementation stage

The previous workshops and meetings allowed the creation of an *Interinstitutional Commission,* which seemed a huge step in consolidating the Management Plan (Caraballo, 2006). However, the project started to debilitate (PUX02, PUX05, PUX07; PUX16). Through time, these commission meetings were held every fortnight, then they were deferred to be held every month, and so on until the commission faded away (PUX04). The operational activities are summarised in Table 7.4 as they unfolded until the commission disappeared.

Table 7.4 Operational activities for the PUX

Activities	Sub-activity	Description
Experiments and actions	Interinstitutional Commission	This Commission was created aiming to translate it into the Management and Development Council of the Management System
		Meeting to set programmes and budget for actions, using POAS as the financial instrument
Behaviours and practices that introduce or operationalise new structures, culture, routines, or actors	Meetings	Interinstitutional Commission meetings, but they faded away
		This commission was formalised through a decree from Mexico City´s Mayor

Experiments and actions

The Management Plan was part of the management process, and the *Interinstitutional Commission* was the continuation of the discussions and negotiations process (from previous workshops) to set plans and programmes to conserve Xochimilco. PUX02 describes that this commission was setting an order to the organisations and institutions working together with the PUX team.

> *The idea was to continue with what Project UNESCO-Xochimilco had achieved, with the flow of information between the different actors…optimise...funds, actions...or any type of movement in Xochimilco, avoiding excessive spending of financial resources, human resources, time… (PUX06.)*

This commission would become the *Management and Development Technical Council* of the proposed Administration System (Caraballo Perichi, 2007). The responsible organism for decision making and public policy (Caraballo, 2006).

This Interinstitutional Commission was created in 2004 under the structure of SEDEMA, to administrate the site and to achieve the UNESCO's requirements (Caraballo, 2006; Ruiz-Gutierrez, 2012). This commission was implemented and worked under UNESCO's team coordination and advisors of Xochimilco Municipality (Caraballo Perichi, 2007), while federal government agencies, the Mexico City's ministries and the three municipalities integrated it (PUX05). This commission was formalised on January 31st, 2005 through a decree from the Mexico City´s Mayor, and held its first session as the *Interinstitutional Commission for the Natural and Cultural conservation in Milpa Alta, Tláhuac and Xochimilco* (Caraballo, 2006; PUX03).

This commission creation allowed for certain inter-institutional dynamics and the opportunity to prepare a budget proposal in 2006. This commission held budgetary meetings, deciding the financial strategy for the plans and programmes, using part of the Municipalities´ budget or POAS—Annual Operating Plan—(UNESCO-Mexico, 2006d; PUX02), which was a requirement by the government to execute the proposed actions for that period (Caraballo Perichi, 2007). However, some interviewees point out that the *Interinstitutional Commission* presented a series of problems. PUX17 describes that the senior directors could not meet often enough to make the right decisions, while PUX05 believes that there was no intention from the agencies to maintain the Management Plan. Participants just took part in this commission because it served as a platform for their political careers (PUX03) while the meetings were more informative than collaborative:

> *There were long and tedious meetings, where ... a large number of those responsible for conducting the policy ... directors or those in charge of agencies, had an absolute ignorance of…Xochimilco…The vast majority…did not know the area…Evidently, they were basically informative meetings, often to justify in some way the work of the governmental institutions. However, there was never an intention… to contribute to the operation and maintenance of the management plan. Not even the … creation of a management office… (PUX05).*

However, from four bodies that would comprise the management unit, just one was created, the *Management and Development Council* through the *Interinstitutional Commission*. The *Executive Committees* and the *Management Unit* were not drafted. Here, it seems that the PUX was overinvolved (managing the *Interinstitutional Commission* or taking the *Management Unit* role, as described by PUX02) instead of dealing with the creation of the other two other bodies. PUX02 describes that the Trust of the Historic Centre[34] had the responsibility of installing the Management System. However, the *Environmental Fund* was not concretised, nor the coordination with the *Mexico Centre Trust* as the plan intended. This trust was not interested in working in Xochimilco (PUX02).

Behaviours and practices

The *Interinstitutional Commission* worked for few months and held some meetings and three plenary sessions (PUX03; PUX04). Here, each representative of the thematic workshops presented the related

[34] Xochimilco has a joined heritage site declaration with Mexico City Historic Centre (Gonzalez-Pozo *et al.*, 2010 and PUX02).

results from previous workshops and their commitments (PUX03). However, this commission became obscured with the time, and participants were disengaging until the commission disappeared (PUX04). Despite there being a decree supporting this commission, the management system had no continuity (PUX05; PUX16).

> *When everyone says yes, nobody ever did it. There were long-term activities that were going to be done until 2018…none of these were done (PUX02).*

PUX03 recalls how in the last session held in San Bernardino church, it became evident that the project had come to an end. The Mexico City Mayor (Alejandro Encinas) and the Minister of SEDEMA (Claudia Sheinbaum) participated, but not Xochimilco´s Municipal President:

> *Everyone was gathered in a moment to set things ... funds… commitments. (The municipal president) ... apologised but that he had had a very important matter … and sent a letter …where he promised to continue supporting. Well, Claudia Sheinbaum left. She said "no, no, no. I am leaving because if the Municipal President does not care, I do not know who will be interested. What could be more important than Xochimilco for him? "... Well, there was no way to push the PUX further at the …Federal District level (PUX03).*

The PUX team was no longer able to continue pushing this venture and had to leave the project (PUX14). This was reinforced by other agencies, like UNESCO and Xochimilco Municipality who asked the PUX to finish and submit the Management Plan (PUX05).

> *Xochimilco municipality and also the Heritage Committee were already urging to submit the site report…and the Management Plan for the area. So, in such a dynamic, we made the plan (PUX03).*

The PUX was extended for four and a half months from October 1st, 2005 to finalise the plan and the administration system proposal (phase three) (UNESCO-Mexico, 2006c, 2006d), but the PUX team stopped pushing the commission and the plan implementation (PUX06). The relation between this team and the government became challenging (PUX02). The Commission was allocated under CORENA, although being the opposite to the independence from the government domain that this commission should have (PUX02; PUX06).

> *There was a meeting where they made us understand… that the idea of the coordination or management unit was not going to be successful…That this … coordination should remain inside…of CORENA and that the project would no longer exist…From there, it was going to continue the plan implementation, which … was never done….The project ended, the office closed, and the involvement of UNESCO terminated (PUX06).*

No other behaviours and practices were included. Furthermore, there was no more communication with the community about what happened at the end (PUX04). PUX04 and PUX11 believe that through diminishing the plan, stopping support for the project and letting it pass away without publicity was a political strategy. Several theories explain why this commission disappeared, the most popular one being that the project never achieved a real commitment and consensus from the participants, while the political period ended and the municipal president changed, causing pressures in the commission´s

viability (PUX02, PUX03, PUX05; PUX16). Other interviewees believe that the growth of the heritage site towards other municipalities implied Xochimilco sharing the UNESCO recognition, and so, the budget and other resources with the neighbour municipalities of Tláhuac and Milpa Alta, something the Xochimilco Municipality was not willing to share, especially when this agency was paying for this project (PUX03; PUX05).

> *Obviously, the creation of the management office…remained in the political arena, challenged presence and participation to the municipality in the crown jewels... of Xochimilco, which is the heritage site. So, imagine an office that competes…with the head of the municipality… Even worse, that… the municipal president paid to reduce (his) political power, the margin of operation… the decision in the territory. It seems ... there was a conflict there (PUX05).*

7.2.4 Evaluation and reflexibility

The PUX finished in March 2006, and the Management Plan was presented and approved by Xochimilco Municipality, the National Institute of Anthropology and History (INAH) and Mexico City government in August (Caraballo Perichi, 2007; PUX01; PUX02). The INAH sent the Management Plan to the World Heritage Centre (PUX02), which sent an answer:

> *…months after its general meeting…the* (WHC) *congratulated and applauded the effort and work, assuming that the world heritage site was already defined. It is unfortunate because the World Heritage Centre is aware that this was done… a management plan that should be implemented immediately (PUX02).*

The Management Plan was not implemented, despite having been published in the Federal District Gazette as a legal document (PUX11). The few results that this project achieved were the Heritage Site area definition, emphasising the importance of Cerro de la Estrella Treatment Plan for Xochimilco's survival (PUX02), and two publications: (1) the *Integral Plan and Management Structure of Xochimilco, Tláhuac and Milpa Alta area inscribed in the list of UNESCO World Heritage* and (2) *Xochimilco: A process of Participatory Management,* commonly known as the *Orange Book*. This second publication detailed the development of the plan, and it was used as a communication platform with the participants involved in this process (PUX06). Here, members of the PUX, academics, civil servants, and neighbours wrote ideas, experiences and perspectives of Xochimilco (Caraballo, 2006; PUX08; PUX09; PUX10; PUX13; PUX16).

Some programmes related to the project were carried out. SEDEREC tried to implement some projects, but they were small and disarticulated, so they did not solve any problem (PUX01, PUX02; PUX07). The *Interinstitutional Commission* was allocated under CORENA´s direction and ceased to exist as it was (RM06). So, there were no monitoring or reflexive activities for this project. However, this section aims to understand the reason why the project stopped and what has been learned about it. The reflective activities are summarised in Table 7.5.

Table 7.5 Reflexive activities for the PUX

Activities	Description
Assessments and Evaluation Thinking about what happened after the project ended	• The Interinstitutional Commission ceased to exist as a space of negotiation • The Indicator system was not implemented • Inadequate institutionalisation of projects. Lack of responsibility or knowing who should finish them, which make projects vulnerable. • No continuity after political/electoral changes. New proposals discharge previous ones • Unable to integrate the community perspective as the PUX relegated the community concerns, the *chinampa* and the agricultural aspects
Governance Processes Ongoing policies, societal changes and lessons learned	**UNESCO 2** in Zacatecas. It represented some leaning as it integrated the model of the Management System. The generated knowledge moved into the experiments of UNESCO (heritage management).
	Heritage Zone Authority copied the idea of a body that coordinates the activities in Xochimilco. However, it does not have the strength to coordinate other agencies.

Assessments and Evaluation

The meetings of the *Interinstitutional Commission* were terminated, and the System of indicators was not implemented. The PUX showed that once the political period finishes, projects become the responsibility of no one, which forces them to disappear, so the Management Plan was not implemented (PUX06). Especially when the project was supposed to be continued by Xochimilco Municipality, but the new president of the Municipality of Xochimilco decided to stop the project. Many participants argue that this was due to the amount of money that this municipality had to pay, while the benefits should have been distributed between the three municipalities (PUX05, PUX07, PUX09; PUX14). However, the other two municipalities did not adopt the plan either. Additionally, Zabaleta-Solís (2010) describes that the Management Plan had to deal with the pressures from other new governments and their new proposals, as the new Mexico City Mayor had many plans in Xochimilco, like an aquarium proposed on 2008 (LaJornada-Staff, 2008). Therefore, the proposal that aimed the conservation was dismissed.

The project has some internal weaknesses, like the inadequate institutionalisation of the Management plan. There were no legal, normative or cognitive rules implemented around it, just the publication of it in the Gazette (PUX03; PUX11), with no further instruction on how and who should implement it (PUX05). According to PUX02, when the PUX was finalising, the main interest was around fighting the Mexico City Centre Trust for funds than to establish the administration system. Hence, there were no mechanisms that guaranteed the PUX continuity nor the *Interinstitutional Commission* transition towards an autonomous body (PUX05).

The PUX has good reviews, as the workshops displayed good involvement and commitment from the participants (PUX03; PUX06), and were highly valued by the community that participated in them:

> *…the UNESCO-Xochimilco project was inclusive, plural and independent of whether the chinampa owners… belonged to… any political party or that they did belong or not to any other group…We (chinampa owners) started to be taken into account (PUX08).*

The PUX gathered the perspective of everybody involved, but it was short in integrating the community perspective into the workshops with the decision-makers. Gradually the project focused on creating better governance but relegating the community concerns, likewise the *chinampa* and the agricultural conservation aspects, as PUX13 argues.

Governance Process

Here, it is difficult to see a simple sight if there was a learning process as the plan was not implemented, and even worse, it is already forgotten. Several participants state how worrying is the fact that the whole plan is already forgotten despite the effort and work comprised in this project (PUX05, PUX13; PUX14).

> *Years later... I heard that someone said in a meeting "to save Xochimilco what we need is a management plan". That are always those moments where one thinks that all the work...was for nothing.... (PUX06).*

Some people that knew about this project, such as PUX15, believe that the whole PUX was just a collection of narratives of experiences and recommendations, but not a Management Plan. PUX02 emphasises that the problem is the lack of mechanisms for knowledge transmission. People pay no attention to what has been done previously, and all the new projects start from scratch, which is later translated into a waste of resources. There is no communication system that transfers what has been done to future enterprises, even though the project was promoted from the governmental sphere. However, there were lessons learnt during this process and seemed they passed into other projects; as two schemes emerged: (1) the *World Heritage Regional Institute* or Category Centre 2[35] (UNESCO 2) in the city of Zacatecas, in the north of Mexico, and (2) the creation of the *Heritage Zone Authority in the area of Xochimilco, Tláhuac and Milpa Alta* (AZP acronym in Spanish).

UNESCO-2 was implemented in the Heritage Zone of Zacatecas, replicating the same model of the PUX and setting an office on site. The main difference here is that INAH and UNESCO-Mexico are working together to maintain the office (PUX02). Moreover, the used structure evolved to comprise the UNESCO Institute Centre 2, which supervises the whole area of Central American and the Caribbean and not just the Heritage conservation in Zacatecas. The structure of UNESCO-2 is a similar model to the Management System proposed by the PUX team, where there is (1) an Administrative Board, structured by representatives of different agencies such as the Technical Council, (2) an Executive Committee, (3) an Advisory Committee, which resembles the Body of Technical Advisors, and (4) the General Management that looks like the Management Unit. Also, this body proposed a differential term

[35] *Instituto Regional del Patrimonio Mundial: Centro Categoría 2.*

for its members, so the renewal of representatives occurs in a staggered way (Parliament of Zacatecas, 2017), alike to what PUX02 describes as a fundamental characteristic for the Management Unit.

The PUX somehow inspired the creation of the *Xochimilco, Tláhuac and Milpa Alta Heritage Zone Authority* (AZP acronym in Spanish), which was created on November 11th, 2012, as the site´s administration body (Gonzalez-Pozo *et al.*, 2016). Some participants argue that this agency´s concept came out of the Management Plan, as it resembles the proposed *Management Unit* (PUX03). However, this agency is not as originally was planned by the PUX, as it depends on Mexico City Mayor (PUX05 and PUX12).

> *That was what we wanted to avoid …because we feared that with the involvement of the city government … the municipal presidents were going to feel that someone is getting into their area of competence, and… that cannot be the basis of good collaboration… (PUX06).*

This agency was responsible for supporting Mexico City Government activities and delegating attributions (or grants) in the Heritage Site (Gobierno de la Ciudad de México, 2012; 2015). This agency formulated general policies and administration functions, promoted actions in the relation of land tenure regulation, reviewed expropriation cases and intervened in the municipalities urban development programmes (Gonzalez-Pozo *et al.*, 2016). Furthermore, the implementation of this office conveyed the complete dissolution of the *Interinstitutional Commission* (Gobierno de la Ciudad de México, 2012). However, it seems that this agency was just a copy of the idea of creating an office that coordinates actions, without conveying any learning. First, this agency had the responsibilities that the metropolitan government previously held (Gobierno de la Ciudad de México, 2012), without any further attribution or mechanism that coordinate the involved municipalities. Second, the AZP had a considerable set of attributions that represent the distribution of grants in the area related to economic and social development goals (Gobierno de la Ciudad de México, 2012), but without any proper integration or coordination of works that strive for site conservation. Also, there are some criticisms against the AZP performance, which remark that this body hardly achieved any progress in Xochimilco due to the internal weakness of this agency (PUX05, PUX10; PUX15). According to PUX05, the most obvious problem that this agency faced was the lack of financial resources:

> *The Mexico City Historic Centre Authority…which is a simile (of the AZP) receives a budget that is about 550, 600 million pesos per year, the Patrimonial Area Authority (Xochimilco) receives 45 or 50, which is like the 10%. However,… look how large area is the Historic Centre of Mexico City? It is small and how large is… the heritage polygon of Xochimilco, Tláhuac and Milpa Alta? (PUX05).*

This agency faced other problems, like limitations in working with other organisations, as it seems there were struggles for power and other restrictions related to the political periods (PUX16), as previously had happened to the *Interinstitutional Commission*. Also, the AZP lacked instruments to force agencies to collaborate and provide funds for coordination ventures (PUX05; PUX17). PUX15 recalls that this

Authority did not collaborate with the Xochimilco Municipality at all, as there was no will to do so (from both agencies) while evoking the existing conflict in the area as he mentions that Xochimilco Municipality is the core of the UNESCO declaration, not the other two municipalities (PUX15). In the end, the AZP worked in certain areas without the power to integrate policies, activities, programmes and plans towards the same direction (PUX09, PUX10; PUX16). It was another agency working in the area with the same limitations as existing agencies. Later, the agency was financing some small projects (Gobierno de la Ciudad de México, 2015; PUX09), but according to PUX05, the AZP already was decommissioned during the last governmental change and passed under the structure of CORENA again.

7.2.5 Synthesis

The PUX had the tremendous support of the municipality of Xochimilco and the community, but gradually it shifted to concentrate in the agencies´ participation, dismissing the community involvement despite that being the primary strategy of this scheme. During the *Tactical Activities*, the project showed some weaknesses, as it focused in involving a vast number of stakeholders and concentrating on a broader scope. At the same time, the municipality displayed uneven support to the PUX (taking some decisions and not assigning a fixed representative for the PUX). Eventually, the involved stakeholders stopped supporting the project as it faded away. This lack of support was evident during the implementation or *Operational Activities*. This may be the moment when the project represented a threat for the actors of the regime. Besides that the end of the political period was near, which represented a disruption into all the regime activities.

The PUX transition management cycle was incomplete, as shown in Figure 7.5. The steering process or experiment was not concluded, there was no reflexive process to provide any learning, and this project disappeared without entering in a cyclical process. Some learning happened, especially in the heritage conservation domain. However, little has been achieved in the water management governance as it seems that the AZP was implemented as a Management Unit, but without contemplating the characteristics that would make it a coordination body.

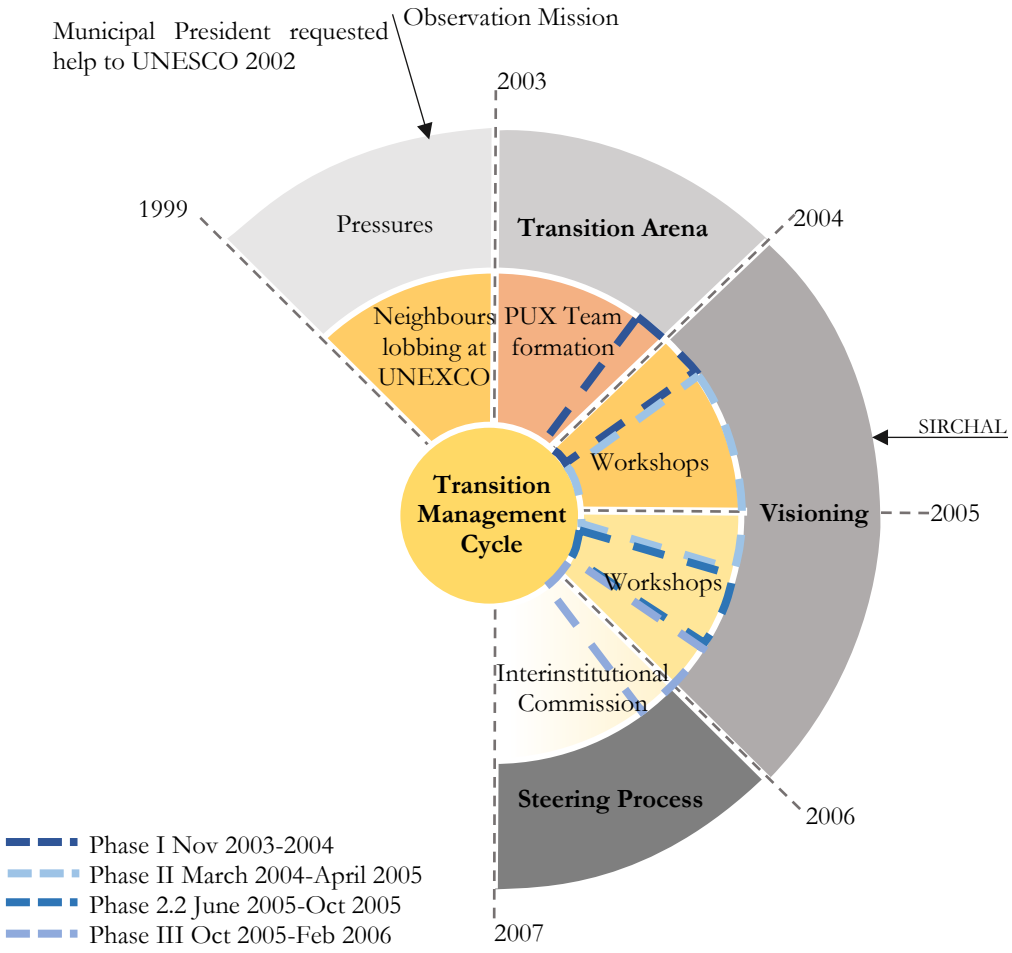

Figure 7.5 The PUX viewed with the Transition Management Lens

The PUX presented some deficiencies, and the internal standards were weak while dismissing some ideas that forge its conceptualisation, like involving the public in the management of Xochimilco. Additionally, the incumbents displayed little support towards the project and in balancing the political context of this site. Thereby, it is important to analyse the regime.

7.3 The Regime behaviour towards the PUX

The Alignment and Processes of the Socio-Technical Regime model helps to visualise the interaction that the project had with the incumbents and the regime. The PUX intended to be a broad project that included an IUWM approach. Therefore, the regime is not just the water system; it also involves the heritage, agriculture and other systems that are interwoven with the water in the region. Still, due to the characteristic of the project, most emphasis is given to the water system and the environment conservation domain.

7.3.1 Institutional Structure

In Xochimilco, there are considerable gaps in responsibilities and limited institutional capacity to implement plans. These problems were witnessed by Arizaga-Guzman (2002), during the 2002 ICOMOS observation mission, states that these issues convey into temporally isolated actions with no follow-up processes. Whereas, there are no mechanisms to align programmes and plans into coordinated goals (Caraballo Perichi, 2007). PUX14 argues that there is not a clear protocol of what agencies should be doing, which translates into low institutionalism, where norms become an option because they do not operate. All of this is related to the political decisions pushing towards particular interests (PUX04).

> *Moreover … there are many struggles between ministries in Mexico City, and… between ministries and the municipalities, so it is impossible that at any moment they could agree… they never agreed (PUX17).*

These gaps of responsibilities and incapability to implement plans is related to the protocols (rules) of the involved agencies. The regulative rules are dispersed and contradictory (PUX04). Thereby, the municipality was in charge of the PUX when it had limited resources, power, a short margin of action and budget (PUX14, PUX15; PUX16), while the responsibility in front of UNESCO lies with the metropolitan government (PUX15). This happened despite that the primary authority in the area being the INAH, the federal institution in charge of heritage management (PUX02, PUX03; PUX04). However, this agency is absent from this site management as it was barely mentioned by the participants, especially its participation in the PUX.

Concerning the normative rules, there is a diverse and vast number of agencies working in the area, from the federal, metropolitan and municipal levels, which generates a lot of duplicity of competences (PUX04; PUX05). A considerable group of agencies is working towards environmental protection. CORENA, SEDEMA, CONAFOR, CONANP, SEMARNAT, and the municipality, among others, which have different projects, programmes and actions in the area (PUX07; PUX09; PUX16). However, these agencies develop certain activities that compete against each other, which eventually is translated into duplicity and contradiction of actions (PUX05). Concerning water management, there is only one agency responsible: SACMEX (PUX15; PUX16). This agency is the sole authority managing the water. However, it is important to consider that SACMEX has no power in preventing practices that minimise the in-aquifer recharges in a conservation area, such as illegal urbanisation (PUX11), thereby it has a narrow margin of action. Other agencies such as Ministry of Agriculture, SEDESOL, SEDECO, SEDEREC (nowadays called SEPI) have a high impact on the site, as they promote certain practices that indirectly affect water quality in the area (i.e. the distribution of agrochemicals that pollute the water, PUX09). This shows a high disproportion in responsibilities. Additionally, it is well known that such agencies are not organised nor has communication with each other, increasing the disorganisation in the area, especially when dealing with the management of this site (PUX12 and PUX13). All these actors are pushing to different sides (PUX01). Even UNESCO is another decision-maker increasing the complexity in the area (PUX12).

Projects are limited to political periods. Most of the participants believe that this issue is one of the most problematic for the site conservation and one of the main factors that prejudiced the PUX (PUX01; PUX02; PUX03; PUX05; PUX11; PUX14; PUX16). Time restriction limits the continuity of the projects, besides the possibility of evaluation and learning from the experiments. Projects are forced to be developed in short periods to match the electoral times, but according to many participants this periods became shorter as there is a lot of time wasted:

> *The time of the municipal administrations…that is three years… it means that a year is lost because in what …they arrived and learned. Then, there is about a year when real work can be done, but then the electoral campaign phase begins for the next administration. Then, there was no possibility of repetition, because there was no possibility of continuity…However, not all of them (civil servants) stayed in their posts during the whole time of the project, there was a lot of rotation…and ….that makes (long-term) projects impossible…Projects with goals as ambitious as rescuing Xochimilco, cannot be fulfilled in three years and less in this effective year that the municipal governments have (PUX06)*

The previous rules are reinforced by the cognitive rules, which are characterised by limited knowledge. PUX03 describes that the members of agencies do not know each other, and thereby, they do not know what the other agencies are doing. PUX11 contemplates that besides that almost everybody recognises the same problems in Xochimilco, the way that every agency approaches such problems and tries to solve them is considerable different, reinforcing the fragmentation of Xochimilco management (PUX04; PUX11). These two factors may explain the repetition and contradiction in the existing plans and the *"lack of unified criteria regarding the programmes that each of the agencies has…" (PUX07).*

There is a considerable number of stakeholders and agencies involved in Xochimilco. However, poor coordination and limited communication among them create a management void, and simultaneously, all the stakeholders´ participation influences the site management. The introduction of IUWM approach in the area seems complicated as everybody influences differently alternative projects and restricts any change in the system.

7.3.2 Infrastructure

The natural water cycle in Xochimilco and Tláhuac is highly altered, as shown in Figure 7.6. Here, infrastructure has played a fundamental role prioritising the water supply and over-extracting the aquifer in the area, and thereby, causing constraints in the channels and wetlands, as water from springs diminishes (Angeles-Serrano *et al.*, 2008; PAOT, 2015). As a compensation measure, the wetlands received little water from treatment plants (Alatriste-Guzmán, 2005; Angeles-Serrano *et al.*, 2008; Aréchiga-Córdoba, 2006; PAOT, 2015), but also illegal discharges of wastewater (Caraballo, 2006; Merlo-Galeazzi & Zambrano, 2014) and releases from the drainage system (PUX04; PUX05). Surface water has been lost due to a series of cracks in the ground caused by the subsidence triggered by the aquifer overexploitation (Angeles-Serrano *et al.*, 2008; Gonzalez-Pozo *et al.*, 2010). Thereby, Xochimilco is vulnerable, a fact that was proven after the September 2017 earthquake, when several kilometres of

Xochimilco canals became dry due to damages in the Cerro de la Estrella Treatment Plant and the supply network (Navarrete, 2017).

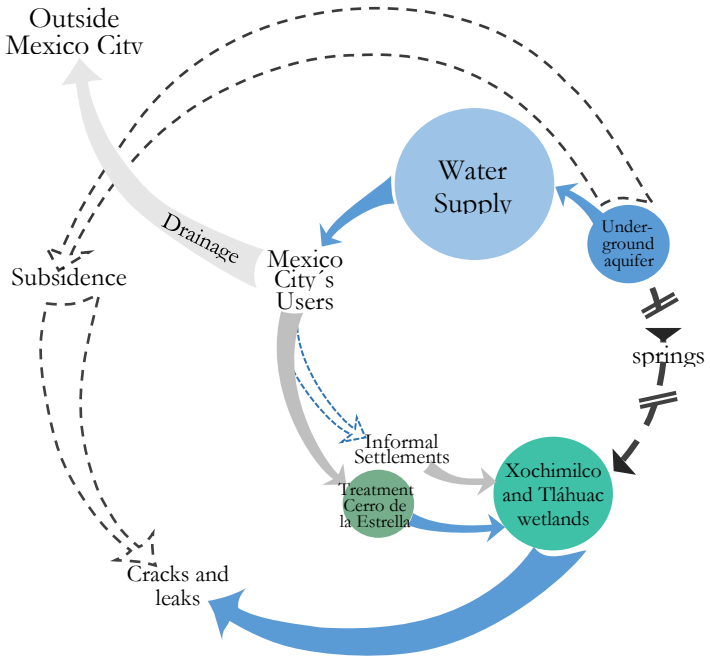

Figure 7.6 Xochimilco altered water cycle

There are four primary water services (or socio-technical systems) in Xochimilco, accompanied by the related infrastructure. These services are water supply (for the city), drainage (or informal infrastructure), wastewater treatment and the wetland. The wetland can deliver recreational services and water for agriculture, among other services, but unfortunately, it is used as a regulation lagoon to diminish the flood risk (PUX13). As an example, drainage water is discharged in Tláhuac every time that the sewage is about to collapse (López, 2006; PUX05). Whereas the Water System discharges black water to Canal Nacional, under the argument that water goes to Cerro de la Estrella treatment plant, but without considering the return flow and that this water pollutes the wetland (PUX04; PUX11).

This lacustrine zone is the responsibility of SACMEX, which is the one in charge of regulating the wetland water levels, but they do it in a disorganised manner. First, this agency sends treated water to the wetland in a very sporadic manner, flooding certain areas while leaving others completely dry (PUX07; PUX09). Although three large dams (San Lucas, Ciénega Chica and Ciénega Grande) store and regulate the surface water in the area (PUX12), the flow in the channels has become very slow or non-existent (Caraballo, 2006).

Water is introduced through a series of pipes that distribute treated water into the wetland, but these pipes were assembled with poor planning as they are visible and restrict the circulation of boats when the water levels drop (PUX07). Water is lost due to a series of cracks that are related to the subsidence

in the area (Angeles-Serrano *et al.*, 2008; Gonzalez-Pozo *et al.*, 2010). Therefore, a series of locks have been implemented locally to control water levels, but they work inefficiently:

> *Basically…operators…manage (the locks)…to their understanding. There is no systematise or measure that tells them when it is time to open (the locks)…They…control the levels because...too much water is being extracted from the wells, so there have been …subsidence…When the level goes down… they ... put sacks to stop too much water going out…They try to control it in some way with the floodgates, up to a certain point they do it. However, everything it is done to the feeling and knowledge of the technicians… (PUX11).*

Some of the locks are created with sacks that can be easily removed and allow local people to manage the channels. Also, there are hatches or locks constructed by SACMEX or the municipality, but some of them have become obsolete because they stopped working, restricting the flow to particular areas (PUX09; PUX17) as shown in Figure 7.7. Additionally, the poor management of the wetland is related to the political and internal problems between the different communities, which they introduce, close and open the channels according to specific interests, instead of a general understanding of how the wetland should work in hydraulic terms (PUX13).

Figure 7.7 Locks to control the channels flow in San Luis Tlaxialtemalco.
The left photograph shows a lock made of sacks, while the right one shows a lock made of steel and concrete that discontinued the flow, which is visible as the vegetation invaded the channel. November 2016. Photograph by F. García-Alba.

Wetland water deficit is also related to the aquifer over-exploitation that is done to supply water to Mexico City (Angeles-Serrano *et al.*, 2008; Gonzalez-Pozo *et al.*, 2016; Legorreta, 2005; Sosa-Rodriguez, 2010; PUX11). SACMEX extracts about three litres of water per second in Xochimilco— two-thirds are supplied to the city, and one third remains in this area— (Gonzalez-Pozo *et al.*, 2016). The problem is that SACMEX continues over-exploiting the area, despite being aware of the consequences generated in the area.

> *… (the) chinampas from…San Gregorio… were the most beautiful chinampas that I have seen in my life... Today they are already sunk … since I was a child, they were going down more and more, due to over-exploitation…with the construction of the aqueduct, which was a blessing for the city…but here it was a curse (PUX09).*

Water in the area is becoming scarce, including the water that is supplied to the city. According to PUX11, there are a series of wells, but some of them (such as the ones located in La Noria) have been closing because it was impossible to continue extracting water from there, which has pushed to make deeper excavations in the area (PUX11).

Water scarcity has put Xochimilco in a vulnerable position, as it currently depends entirely on the water from the treatment plants for continuing to have water in the channels and maintain the traditional agriculture (PUX06, PUX11). However, treated water is not enough (PUX15). Gonzalez-Pozo *et al.* (2016) describe that treated water reinjection into the site (1,268,400 m^3) only constitutes 30% of the whole treated water production in Mexico City.

Another problem is the water quality in the wetland. According to PUX02 and PUX11, treated water quality rapidly diminishes once it enters into the site due to illegal discharges or *informal infrastructures*. Informal settlements discharge wastewater into the channels as a manner to provide themselves with services.

> *There are a lot of irregular discharges of people who settled on the banks of the lake and have no drainage, so their drain discharges go to the canals. Then, all the investment that could have been made with wastewater treatment to maintain the lacustrine system comes down with all irregular discharges. …Irregular settlements…cannot get drainage because it is like giving them ... officially you are here, this is your address. So, they cannot give them that kind of service, and there is no way to say "do not discharge here"(PUX11).*

This infrastructure, outside the formal system, that continuously alters the wetland cannot be modified as it enters into the matter of politics and power struggles. The regime minimises the issue or attends it in a political manner (Section 7.3.6).

The wetland is also influenced by environmental conservation and agriculture practices. In regards to the environmental protection, there are a series of practices and projects that promote reforestation, channels cleaning, *chinampas* stalking and sack locks arrangements, among others (PUX04; PUX12; PUX17). However, these activities represent disjointed actions, producing limited results in the environment (PUX04), but permeate struggles from the political dimension into the society (PUX07). In the present, the local population do not practise conservation works because the government forbid them (i.e. mistletoe pruning) or because they do not receive compensation for it (i.e. removing water lilies), despite the benefits of continue doing such practices (PUX09). Certain population demands compensation to do any job that they used to do before for free, such as road restoration and channel cleaning (PUX07).

Something similar happens with the programmes or infrastructure that are implemented to encourage the conservation and productivity of agriculture. Greenhouses have been widely introduced in the area to promote agriculture, but contrary to what the UNESCO declaration aims to protect, the traditional agriculture or *chinampas*. Greenhouses were introduced in the late 1970s as an agricultural alternative to low water quality. Merlín-Uribe *et al.,* (2013b) explain that greenhouses were introduced here by the

government to compensate landowners for sunken or flooded *chinampas*. Farmers placed the greenhouses over *chinampas* and started to depend on exogenous technology to maintain the production, like irrigation systems, modified seeds, and chemical fertilisers (Angeles-Serrano *et al.*, 2008). Narchi & Canabal-Cristiani (2015) explain that new technology caused more pollution into the wetlands and channels, as greenhouse production also includes the use of herbicides and pesticides. Greenhouses are highly promoted by the authorities, despite not representing a better revenue compared to *chinampas*. Governments allocate twice the budget of *chinampas* maintenance into greenhouses subsidies (Narchi & Canabal-Cristiani, 2015). Merlín-Uribe *et al.,* (2013b) describe that greenhouses increase due to a combination of variables, such as government subsidies and the free use of electricity. However, behind this production programme, there is also a *clientelism* background to gain votes and political favours (PUX13) while the introduction of greenhouses has proven to encourage the informal urbanisation of the natural area:

> *When there are abandoned chinampas, someone… put a greenhouse to improve it…A structure is made, that structure needs someone to take care of it… then it starts to be infrastructure, having … water,… electricity and then… grows…Then, it goes from chinampa to greenhouse, greenhouse to urbanisation…(PUX 13).*

As a summary, the agencies have intervened on the site with little understanding and very poor planning, evidencing the importance of the next sub-regime.

7.3.3 Knowledge

This sub-regime involves the existing knowledgebase and what is disregarded about the site and the wetland. Xochimilco´s neglected state is the result of a series of processes that desiccated and reduced a significant part of the wetlands, leading to its ecological and economic degradation (PAOT, 2015). Despite knowing the consequences of everyday practices, stakeholders continue such behaviours because other variables limit them, for example, continuing the supply of water due to the enormous demand of Mexico City even though Xochimilco subsidence (PUX11; PUX16). The community is aware of the damages that everyday practices are causing to the site, such as the use of herbicides and fertilisers, but they refuse to change their behaviours because they do not know about alternatives. They continue such practices as they respond to the means of subsistence of farmers (PUX04 and Fieldtrip: November 16th, 2016).

The use of chemicals (i.e. fertilisers) can be considered as *Hidden Information* as they are external activities to the water system, and the use of the chemicals are related to other agencies that are not associated to the water management but want to maintain some control in the area (*Hidden Actions*) (PUX07). Hence, there is a knowledge void created by institutional disorganisation. The intertwined relationship between community and agencies (*Hidden Actions*) is noticeable in the conservation practices, as the community should develop these works, but encourage political or clientelism practices:

> *…(the people) of the SEDEREC, CORENA … AZP… have their friends…and give (the projects) to them, "a (programme) ... will come out … I will help you, but you know a percentage is for me, I design the project for you " (PUX09).*

There is not enough knowledge about how and who can develop such practices (PUX09), which ends up restricting the population that is involved. Other practices are restricted for the population because they need permission and make related payments for performing them (i.e. tree pruning to remove mistletoe) under the argument that they need a "*preventative report on the environmental impact"* (PUX07). Hence, it can be stated that some knowledge gaps (*Hidden Actions*) are maintained in the area due to political behaviours while responding to different interests.

According to PUX11, Xochimilco management is the result of the disorganised growth of Mexico City and the chaotic provision of services, while PUX13 states that the problem is the knowledge that the water agency has:

> *They have visions of the last century, literally from the last century. From countries such as England or... United States (but from) the beginning of the last century…The hydraulic managing is bad….remains the same since 20 or 30 years ago… (PUX13).*

PUX07 describes that SACMEX sells water to some companies in the area during the dry season, but then this water is sent to the wetlands during the rainy season, causing floods. This information can be considered gossips but illustrates that there is a considerable lack of knowledge about the site´s management. This is because the regime manages Xochimilco and operates the infrastructure with insufficient information. SACMEX delegates the control of lock gates and the wetlands flow levels to local operators and the community that control the system without information and in a segmented manner. Here, the regime members are not even aware of how the system is controlled.

7.3.4 Financial resources and users

The maintenance of Xochimilco is highly expensive (Caraballo, 2006), and any substantial change requires a substantial investment (PUX14). Therefore, it is necessary for the involvement of the government (besides that is a condition of UNESCO). However, there are a series of contradictions that are related to institutional sub-regime. First, federal resources are limited because it is required that stakeholders and institutions organise in order to receive such resources, which rarely happens (PUX04; PUX17). The funding as a Heritage site depends on the Mexico City Historical Centre Trust, which was already limited (PUX05), but this funding becomes more restricted once the Heritage site grew to include Tláhuac and Milpa Alta, besides Xochimilco (PUX02).

"A *lot of money has been spent, an impressive amount of money has been spent and at the end …. there have been no solutions, not even partial ones" (*PUX11). This is because different agencies have diverse programmes and manners to introduce capital in the site (PUX07), but these resources have been distributed inefficiently.

PUX13 argues that money is allocated to government programmes that barely permeates to the local population:

> *Marcelo Ebrard (Mayor) put 400 million pesos to Xochimilco in the last three years of his government, and we do not know where they are. Four hundred million pesos is not any little thing; I could have done much more with that (PUX13).*

Resources are mostly allocated through programmes to help the local population economically and support agriculture, such as the payments for environmental services (Perez-Campuzano *et al.*, 2016; and Fieldtrip November 19th, 2016). However, these payments tend to be small and do not represent a solution for the peasant subsistence nor a mean to maintain the *chinampas* (PUX11). This is because these investments for conservation are in direct competition with the value of the land. It is more profitable to sell the land for urbanisation than continue working it. PUX03 explains that this competition becomes more intense when the government promotes projects such as the Underground Line 12, as there is an indirect strategy to promote urbanisation over conservation. Therefore, these conservation payments and programmes tend to become paternalistic and political tactics to gain power.

In Xochimilco, there are two types of users: domestic and agriculture users. In this particular case, the domestic users involved the whole population of Mexico City, as water from Xochimilco is extracted to satisfy this metropolis (Angeles-Serrano *et al.*, 2008; Gonzalez-Pozo *et al.*, 2016). The agriculture users *(chinampa* landowners, communal landowners or *ejidatarios*) who consume water through the channels[36] are those located in Xochimilco and Tláhuac. The problem is the competition between two user groups, as both need water. However, the regime prioritises the domestic users (except in Xochimilco, a considerable section of the population receives water from pipe trucks, PUX11), which contributes to the loss of agriculture in the area (Figure 7.8). Also, PUX09 and PUX11 describe that it is more difficult to cultivate the *chinampas* as water does not permeate into the ground as it used to, due to the low levels in the channels.

Urban water demand maintains the existing practices and behaviours in Xochimilco (PUX11). Meanwhile, agriculture users and the natural environment (as a user) received limited treated water, despite being the *"users"* that conserve Xochimilco as a UNESCO´s Heritage Site. The water system favours the domestic users, which is also supported by the law that prioritises them over other users (Birrichaga, 2009). However, the agreements with the UNESCO, at the moment to sign on Xochimilco as an outstanding place, involves the commitment of the state party on maintaining the site, and the RAMSAR agreement stipulates the conservation of water in the inscribed wetland (WWF-Fundación Gonzalo Río Arronte and CONAGUA, 2011; Interview E), which happens but in a deficient manner (PUX07, PUX09; PUX13).

[36] During the fieldtrip November 19th, 2016, some peasants describe that they use fresh water to irrigate certain plants (such as poinsettia), because they are afraid that the bad quality of water in the channels can ruin the product.

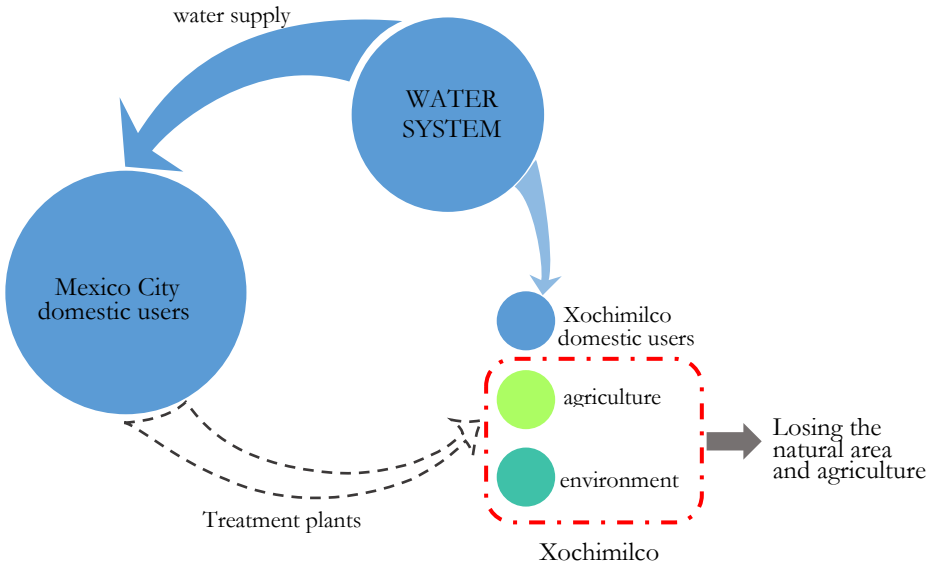

Figure 7.8 Water users linked to Xochimilco water system

There is a contradiction as the peasants are the owners of the land (del Roble Pensado, 2001; Robles-Berlanga, 2000), and they also recognise themselves as the owners of water (PUX08; PUX09). However, historically they have been forced to resign to having such water and giving it to Mexico City. They have witnessed the institutional unwillingness on helping them to maintain this site as there are two discourses. One that invites them to keep working the land because it is tradition, and the other that tells how they are alone in this work, as agencies keep over-exploiting the water. Besides peasants, *chinampa* owners and *ejidatarios* do not receive benefits for keeping the Heritage Site declaration (Merlín-Uribe *et al.*, 2013b).

Xochimilco is highly vulnerable to the metropolitan needs for freshwater, which undermines the conservation of the site under the water *"market"* of the city (despite that is not a market). Additionally, the local food system also depends on Xochimilco's surface water, which has been affected by inadequate water management (PUX07; PUX11). This has limited the possibilities of creating a food market that can help to preserve this site and ease the incorporation of Integrated Urban Water Management approaches. However, this problem and the food system requires a separated thesis.

7.3.5 Participatory governance

This subsystem is minimal as participants seem to recall that the PUX was the first time they were involved in the decision making (PUX08; PU09). Historically, the Xochimilco community had their hands tied when the authorities wanted to intervene in the area. These practices have permeated into the community, resulting in resentment towards the authorities and limiting their participation in resources management. They have been forced to resign to their rights to satisfy external needs. The most famous

example is the Ecological Rescue of Xochimilco Plan implemented in 1989 (PUX09; PUX12). Narchi & Canabal-Cristiani (2015) explain that this plan was the response of the former president Carlos Salinas to UNESCO's concerns about this site's preservation. This plan was based on communal land (or *ejidos*) expropriation (PUX12) but ostracised by the communal landowners of Xochimilco and San Gregorio Atlapulco (PUX08). According to Gonzalez-Pozo *et al.* (2010), the communal landowners even elaborated an alternative proposal focusing on the hydrologic restoration and the creation of a regional water committee to involve the community in the decision-making process. This community proposal led the authorities to make some minor changes to the project but without any significant alteration. However, considerable land (1038ha) was appropriated despite the community objections (Gonzalez-Pozo *et al.*, 2010; Legorreta, 2005).

This appropriated land became the *Natural Protected Area of Xochimilco and San Gregorio Atlapulco Ejidos* (ANP-EXSGA, acronym in Spanish) (Legorreta, 2005), but without solving any of the main problems of Xochimilco (Gonzalez-Pozo *et al.*, 2010; Legorreta, 2005) [37]. Instead, it increased the site's crisis, as more *chinampas* were abandoned and informal urbanisation spread (Amalacachico, Toltenco and Amelacos) (PUX12). Therefore, the local population tend to have considerable doubts when the government proposed new programmes and plans (PUX04, PUX08; PUX09).

> *If you go to Xochimilco and say "I am doing a job and I come from the UAM Xochimilco" there is no problem, they let you enter in the chinampas…, but if you tell them that you are on behalf of the municipality, there is a barrier … in automatic… (PUX04).*

Also, the community is divided about allowing participatory projects to happen. As an example, the restoration of Urrutia Bridge was stopped by the San Gregorio Atlapulco *ejido* leader because it represents (political or economic) interest for the previous *ejido* leader (PUX17). This factor also links this subsystem with the political and power struggles dimension. Despite the effort of projects to include the society in decision making, this is already restricted due to community distrust and struggles in the area.

7.3.6 Public policies, political power and struggles

Participants describe how political struggles and political interests are clearly evident in Xochimilco (PUX06; PUX09), as they shape institutions behaviours and influence the distribution of resources (PUX02). Also, power struggles create a series of secondary behaviours, such as corrupt practices and coalitions between different actors, a complex network of behaviours that reinforce each other, dominant groups or personal interests over the site conservation, as the site:

> *(Conserving the site)…does not represent anything to (the authorities) so … (they) can continue to keep (their) group in power. It is such the level of perversion … in the public policy at the local level...and*

[37] PUX09 describes that land expropriation also occurred after the ANP and the Ecological Park creation were constructed, as some of his *chinampas* were expropriated to locate the office of CORENA.

> *how it is so short-term … Governments… are more concerned about gaining customers (voters) for the next government period, than in …governing (PUX14).*

These political struggles have translated into the community, dividing it. Therefore, it is quite common to observe disagreements between different groups, such as *ejidatarios* and *chinampa* owners, who oppose whatever benefits the other group, especially because such group represents the contrary political affiliation (PUX17). PUX14 describes that struggles become evident during the electoral period when it is common that groups and organised community get involved in political disputes, and there are forced to take sides, which will reward them with grants and programme investments.

These struggles are also related to the policy in the area that tends to be incompatible with Heritage protection (Gonzalez-Pozo *et al.*, 2016). Narchi & Canabal-Cristiani (2016) argue that the UNESCO declaration only consolidated the governmental power in the area, as the government uses this declaration to consolidate its programmes that are external to the heritage conservation (i.e. Ecological Park). The existing policy exacerbates the condition of the site as it has been relegated under tourism promotion practices since being declared a World Heritage Site (Delgadillo-Polanco, 2009). Most of the programmes in the area have focused on using the site for commercial and financial use, without contemplating the sustainable use of natural resources or mitigating the economic and social disadvantages of the rural population (del Roble Pensado, 2001).

The area is over-regulated which causes difficultly in the management of this site, as there are regulations and laws from the federal, metropolitan and local governments that overlap, contradict and restrict each other (PUX12; PUX14). As an example, the law that prevails in conservation is the Federal Law of Monuments and Sites, which was issued in 1972. However, in essence, it has not been modified since then, and so is short of the needs of today, as it was written for another socio-temporal context (PUX03; PUX04). Also, the site has other declarations, such as RAMSAR (PUX02), *Globally Important Agricultural Heritage Systems* or GIAHS (PUX09), the Natural Protected Area declaration, among others (Gonzalez-Pozo *et al.*, 2010). However, there is no unified legislation that protects the area and the lacustrine system, and the legal disorganisation transfers here and in the institutional dimension (PUX07).

Wigle (2014) describes that even though most of the area is catalogued as Conservation Land and the existence of strict protection laws, urbanisation practices continue in the area because existing norms and regulations tend to be not fully applied or are applied unevenly, as there are no mechanisms to monitor and regulate what is required (Reforma-Staff, 2007c; Wigle, 2014; PUX16). PUX11 considers that rules are strict, but there is no monitoring to check that such rules comply, while PUX17 believes that this is related to the lack of strength of the institutions in making rules compulsory. Simultaneously, other regulations allow the site´s deterioration, as the case of the reform of Article 27 of the Constitution that happened in 1989 (Olivera-Lozano, 2005), which allowed *ejidatarios* and communal landowners to sell the land, increasing the opportunity cost of agriculture (PUX08).

PUX08 argues that the existing policy or the lack of it contributes to the population divisions. There is little knowledge and legal background that supports the ownership of *chinampas* (PUX02), creating certain complexity as "*not all ejidatarios are chinampa owners and not all chinampa owners are ejidatarios*" (PUX08). The *ejido* has some legal protection, but not the *chinampas* (PUX08) According to PUX07, this has created deficiency when economic support or programmes are distributed to peasants. Furthermore, the differential distribution of grants and the legal differentiation has helped to permeate clientelism practices (PUX09) while dividing the local population that resents this differentiation (PUX08).

> *Each … municipal administration has a particular inclination toward specific groups and depending on that, is how the boat moves. In some occasions, the chinampa owners have been benefited …in other occasions the merchants…or transporters. Each interest group has ensured its convenience… everyone has their mechanics…their ways of putting pressure on the authorities… well-established schemes (PUX04).*

Interests and several forces are pushing the implementation of some projects or plans while diminishing others. That is why programmes such as the *chinampa* stalking remain and grow, despite that PUX09 and PUX17 describing the ineffectiveness of such project, as it is not the traditional stalking, which results in a temporal barrier to contain the *chinampas*[38]. However, this programme continues even through different political periods because it represents revenues for someone (PUX09; PUX17). Therefore, it can be stated that water management becomes very complex because it reflects the power struggles.

7.3.7 Cultural significance and association of the regime

Xochimilco has been managed with a certain logic that has pushed urban projects from upper political spheres, without contemplating the character of the site. Narchi & Canabal-Cristiani (2015) believe that projects in the area are highly embedded in the neoliberal discourse, which means that nature preservation is worth it if there is immediate economic profit obtained from it. Therefore, government and private investors facilitate lucrative projects, such as touristic, recreational and housing developments (Arizaga-Guzman, 2002). Henceforth, the government occasionally involves well-known stakeholders to develop projects for the restoration of Xochimilco (i.e. Norten Arquitectos or Dutch consultants) (Juárez, 2016; Sanchez, 2010; PUX13) However, agencies and governments support these projects to fulfil political goals (or a political image), using projects as a type of publicity but relegating the conservation goals (PUX05; PUX11). This political goal pushes projects to be replaced rapidly as every time that there is a new administration, a new and personal project is proposed, discarding the previous initiatives, such as the PUX.

> *"I come, I delete and a new account. Nothing that was done before is worth it"... There is an inability … to see what has been done. (In a new administration) the whole structure changes, all of it, and no one has any idea of (what has been done previously) (PUX14).*

[38] PUX17 describes that stakes are put around the *chinampa*, but between stakes there is also a net, which eventually degrades and contaminates the wetland.

Xochimilco is well associated with tourism or recreation practices, something that has been reinforced with the site inscription to the Heritage Site List (Caraballo, 2006). This touristic background continuously influences the site management prioritising water distribution to the touristic wharves (del Roble Pensado, 2001; Delgadillo-Polanco, 2009), while relegating the cultural aspects and the local knowledge (Arizaga-Guzman, 2002; Narchi & Canabal-Cristiani, 2015; PUX11). This affects the policy, power struggles, users, institutions and other sub-regimes that gradually are replacing the original character of this area or sub-basin from agricultural to recreational (PUX02).

The site has been managed with several visions and several goals, which have favoured tourism and other practices over the environment and agriculture conservation, the core of the UNESCO declaration (PUX07). Thereby, the importance in aligning the vision of all the stakeholders towards the same directions as the PUX proposed (PUX01, PU02; PUX17). Xochimilco must be understood as a system that interlaces with several domains (like water, heritage, and food provision, among others).

7.3.8 Context

The population of Xochimilco is complex and highly divided, while PUX04 recognises that struggles are growing within the civil society (PUX04). These struggles escalate due to the politicisation of the community, which is visible in the coalitions that emerge between different social actors and authorities. These coalitions stimulate informal urbanisation and services provision and the uneven distribution of programmes and grants that exchanged for political support or votes (Narchi, 2013; Wigle, 2014; PUX09; PUX11), but encourages paternalistic and clientelistic practices that further divide the population:

> *…a spillway (or lock) was proposed due to the differential subsidence in Chalco Canal …but people protested, "No, they will not do it" … Why? Because"… One comes out, another comes in "I want". "No, I want"… A committee has to be comprised… The authority… says "this one is from my group, so I give to him, then … the other one is not (from the group) I do not give to him, then he… comes and jumps (over) him"…(PUX07).*

There are a series of confronted groups throughout the Heritage Site, like different groups of peasants that are affiliated to different political parties (PUX08), the local population that does not let no natives cultivate the land (PUX17), and whoever wants the grants and benefits of institutional programmes stops projects if that means a benefit to somebody else:

> *People…wants to receive the (economic) resources …and does not let the other to participate…there is an antagonism inside the communities….to these projects… For example, in the case where sections needed to be measured to raise levels for the channels either to (allocate)… sacks, a lock or a certain work... the owner (of the lot) said "…No, I will not let them" (PUX07).*

In the urban planning scale, Xochimilco is also vulnerable to the considerable contradiction that exists between different projects and different systems. Thereby, a motorway (Orient Urban Motorway[39]) and

[39] Orient Urban Motorway Muyuguarda-Bilbao section.

the underground transport system (workshops and the final station for the Line 12) is constructed over Xochimilco and Tláhuac *chinampa* area, contradicting the commitments made with UNESCO (Gonzalez-Pozo *et al.*, 2016; Voss, Woodcock, & Zambrano, 2015; PUX03; PUX04). In a broader scale, Xochimilco is also vulnerable as water scarcity in the country, which conveys the increment of water demand. This factor and the growth of neighbouring cities will increase the competition for water that comes from external resources (PUX06). This event might increase the extraction of water in Xochimilco, creating adverse effects, but there are no plans of how to deal with this risk. Thereby, it is necessary to consider the broader context of Xochimilco to understand better how to manage this area.

7.3.9 Synthesis

Public policies and political power comprise the strongest sub-regime and influence the other sub-systems, as they involve behaviours related to power struggles. The second most robust dimension is infrastructure because Xochimilco has been heavily intervened and the existing structures, like locks and treatment plants, play a fundamental role in maintaining the site and the surface water. Financial resources are used to maintain the site through allocating programmes and grants for conservation projects, assisting the institutional structure in maintaining power and creating some alliances with the population. Hence, the regime´s political power shapes the social system through financial resources, transferring conflict to the social context. Additionally, infrastructure is used as a conflict too due to the involvement of the social system in the regime- It is used to divide the community with grants and programmes. These impacts increase the size of the infrastructure strength in this site, as shown inFigure 7.9.

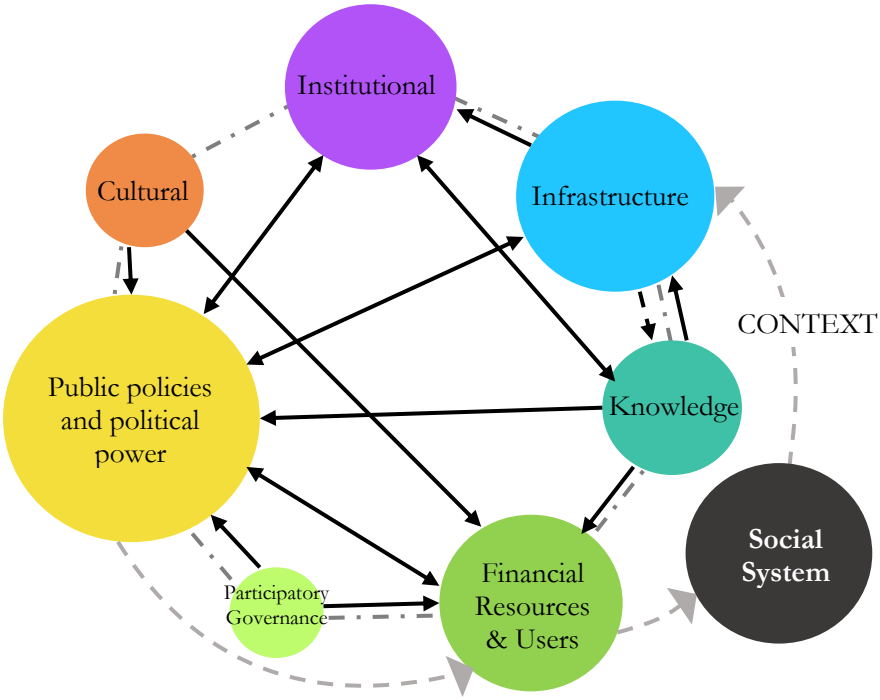

Figure 7.9 The regime in Xochimilco

The other three sub-regimes are weak. Although there is knowledge about the site, this tends to be disregarded to maintain everyday practices. The cultural dimension is reinforced with the productive perspective of seeing water in Mexico as a supply service, complicating sustainable practices. Finally, the smallest sub-regime is the participatory governance that is significantly influenced by power struggles, but barely disturbing the regime structure, despite public participation being supported by the policy in the country.

This analysis displays how some regime actors can influence the context (social system). Political struggles had been translated into society, and now the community also influence other sub-regimes. This is quite evident in the case of how sluices and locks are managed, playing a political role rather than a conservational one. This political intermission of incumbents in the society can have a reinforcing effect in the regime behaviour or may finally disrupt it, as PUX04 believes that existing struggles are going to explode one day.

7.4 Niche-Regime Dynamics

The previous sections help to analyse the project and the regime but do not illustrate how the regime changed as the project grew to represent a tension for some incumbents. Figure 7.10 represents how the PUX was a response to pressure from the social system because some neighbours demanded to preserve the natural character and the heritage of Xochimilco. This was translated into the government actors requesting a change in the regime. Then, incumbents decided to participate in Project UNESCO-Xochimilco, delivering its greatest support during the *Tactical Activities*. However, some issues emerged during this stage. The project proposed order into the institutional structure while providing some knowledge to the regime and engaging the users (community, tourist providers, *chinampa* owners and farmers, among others). However, the new knowledge was not compatible with the cultural significance of water. Water for conservation was introduced but contradicted the functional vision of this resource. The institutional order conveyed some political struggles, especially the incumbent actors were not willing to fully participate in the project or deliver some power to it, like the municipal president of Xochimilco. The support of the regime diminished as power tensions became recognisable because the project proposed that incumbent actors should share power (1) between different agencies that have to coordinate works, programmes, funds and other resources, and (2) Xochimilco would have to share the UNESCO recognition and other benefits with the two neighbouring municipalities. However, not all the actors were willing to do that, especially when considering the high politicisation of the area.

The PUX was already weak during the *Operational Activities*. Some funding was assigned but not distributed, and the project faded away. The PUX had no *Reflexive Activities* as incumbents stopped support and restricted the knowledge generation or the plan communication. This was reinforced by the change of administration. However, political struggles were still represented, as shown in Figure 7.10, as some participants (PUX04; PUX11) believe that the manner that knowledge about the plan was managed was a political strategy to dismiss it.

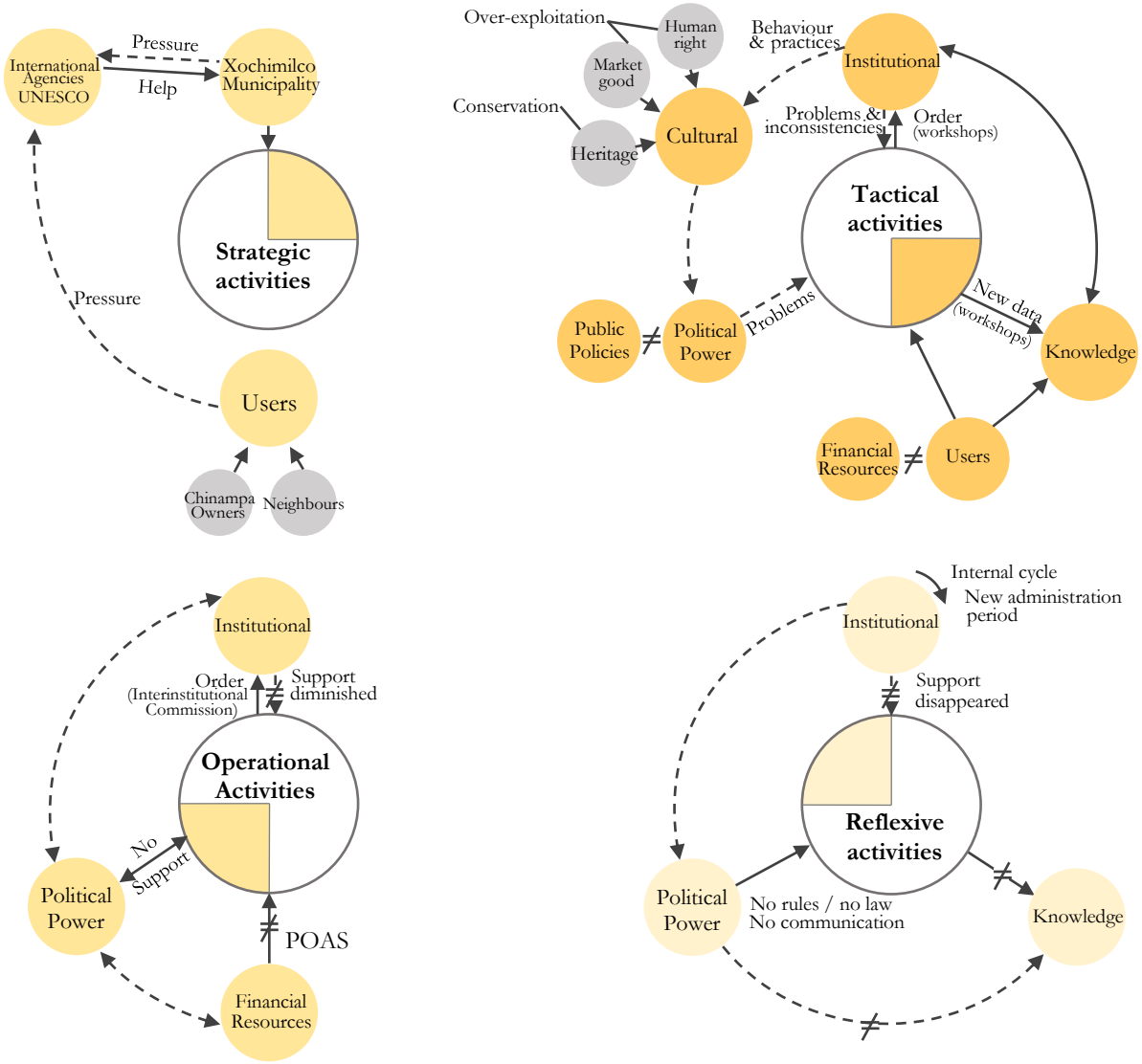

Figure 7.10 Dynamics between the regime and the PUX

Figure 7.10 shows two main issues of the framework: (1) the users do not contribute to the economic resources to maintain the site nor to change how the water is managed, and (2) public policies are different from political power. These two can contradict each other as public policies can be considered a formal practice of the regime, but political power tends to respond to informal pressures rather than a policy. Still, the link between the institutional structure and power is quite strong despite that it is not recognisable or formal, so it is represented with a dotted line. Additionally, infrastructure is not illustrated in the diagram, but the previous analysis displays that it has a fundamental role in shaping Xochimilco. This is because the PUX focused on the site governance and did not represent a direct conflict to the existing infrastructure. However, in Xochimilco, the existing infrastructure can be considered local (locks and pipes to maintain the surface water levels) and metropolitan (water supply to the city). Hence, the infrastructure it is not evident in the diagram as the project had a local scale, but conflicts arose on a metropolitan scale. This leads to the belief that it is necessary to establish different scales in the analysis

since the users and the entire water system of Mexico City (a larger scale) created the overexploitation that is rarely considered when designing local water management approaches.

7.5 Summary

The analysis shows that the PUX comprised two different schemes: a management plan design and the area definition of the heritage site. The objectives of these different schemes created conflicts, mainly because the project emerged to ease the political rumours that arose around Xochimilco decadence. Hence, this project´s main goal was to create a new image of the politicians (Municipal President) supporting it, but the project evolved to invite other actors in Milpa Alta and Tláhuac municipalities to share that image, which increased power struggles. Then, the project was not strong enough and faded away once the administration change occurred. This is also related to the institutional logic of the regime, which forces projects to be done within the same logic and be finished within the political/electoral time. Meaning, the project was left unfinished and the Management Plan was never implemented.

These type of projects are vulnerable as they represent tensions to the incumbents who tend to maintain the regime and respond to the projects with other pressures. However, when the regime is not balanced, it tends to be due to specific dimensions. The regime sub-dimensions have different strengths and sizes. Power struggles are the most significant dimension and influence the other sub-regimes; this is also because the regime and incumbents are well-embedded in the governmental structure, and so, existing political dynamics. This is a matter of concern, as projects such as those with IUWM approaches see themselves as apolitical, but they have to interact heavily with political matters and power struggles from the beginning. Whereas, the public policy and the institutional structures are unable to balance such political tensions. On the contrary, the weakness in the policy (the lack of coherent legislation and the recognition the existing laws) and institutional disorganisation increase the political conflicts, complicating the implementation of alternative approaches.

Chapter eight

8 Discussion

This chapter recognises the similarities and differences in comparing the two case-studies by using the presented frameworks and integrates the findings with the existing literature. The results of the two cases are summarised in Section 8.1. The role of incumbents in regime transformations is presented in Section 8.2. Section 8.3 describes the concerns around power, while Section 8.4 explains the outcomes and processes that emerge from incumbent-led experiments. The chapter finalises with a summary in Section 8.5.

8.1 The studied cases and the transition trajectory

Urban water management in Mexico City is highly deficient, and the high resistance to change it threats natural resource availability. Experiments supporting IUWM has been promoted but poorly supported by incumbents, while the regime behaviour continues representing a limitation to sustainable practices. This section presents the main characteristics of the experiments by using the Transition Management Framework, the studied socio-technical system and the context to recognise the main limitations for transitions in the studied sites.

The development of experiments

The Magdalena River Restoration Project and the Project UNESCO-Xochimilco were very similar, as the Transition Management framework displays. Both projects had similar objectives, approaches, proposed conservation plans and aimed to improve water bodies' conditions while involving the community. During the operational activities, the two projects faded away and there was not a reflexive stage, as shown in Figure 8.1. These two projects came to represent problems to the incumbents who stopped supporting them, a decision reinforced by political periods.

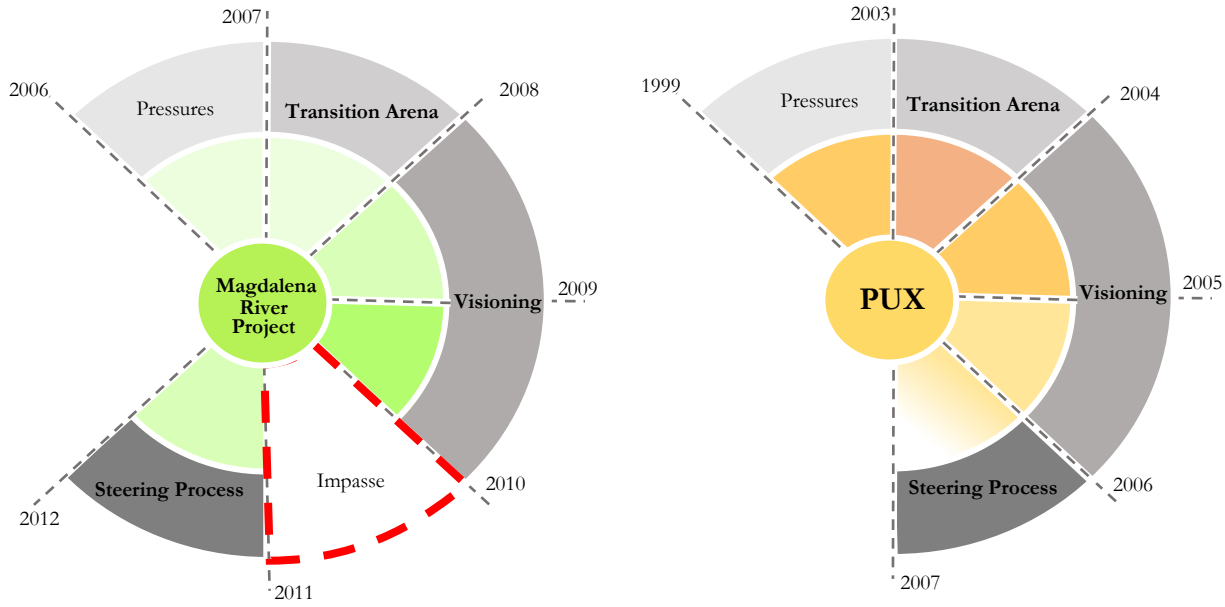

Figure 8.1 The two cases through the Transition Management lens
Magdalena River Restoration Project in green and the Project UNESCO-Xochimilco in yellow

These projects presented problems related to lack of power or to become structured and part of the regime. This is because two main issues emerged: (1) there was no internal evaluation that set and guide the internal performance of the projects, and (2) the support from incumbents and regimes was intermittent.

During the *Strategic Activities*, the two projects agreed the interdisciplinary, inter-institutional and integrated design of Master Plans to guide the management processes, stipulating a shared responsibility between all the stakeholders. Thereby, the community should be included in the decision-making. The goals stipulated to institutionalise the plans and achieve the long-term conservation of both sites and their natural character, involving the conservation of broader aspects (the basin and the heritage). Also, both projects proposed *systems of indicators* to evaluate the development of the projects, among other strategies. However, there was no legal framework (regime´s support) as part of the norm-setting for Xochimilco (PUX01). For the Magdalena project, there was a legal framework supporting the Master Plan, the 2007 Green Plan and the Water Sustainable Management Plan. Moreover, a new structure was created (the Sustainable Development Cabinet) to coordinate all the involved agencies. However, this legal framework was never mentioned again, as it never supported the plan. There was limited empowerment from the beginning.

The two projects were defined through workshops as part of the *Tactical Activities*, as shown in Figure 8.2. The Magdalena River Restoration Project was a linear process. SEDEMA terminated the design process to avoid the political problems generated in the *Advocacy Group* and delivered the Master Plan to the academics involved. This created a divided procedure instead of a unified process, fragmenting the project. Community participation workshops were developed but with no relation to the Master Plan. The PUX accomplished a comprehensive programme, gathering a wide range of participants. These workshops were developed as a process, as some strategies and tactics were defined in workshops (i.e. participants recognised what they can do for the site). These workshops evolved towards consequent activities involving further decisions, working meetings and negotiation spaces and were translated into a new management structure (*Interinstitutional Commission*). However, the general perception was that the two types of workshops (community and agencies) were not relating to each other and there were no mechanisms to include the stakeholders of the neighbouring municipalities once the intervention area grew.

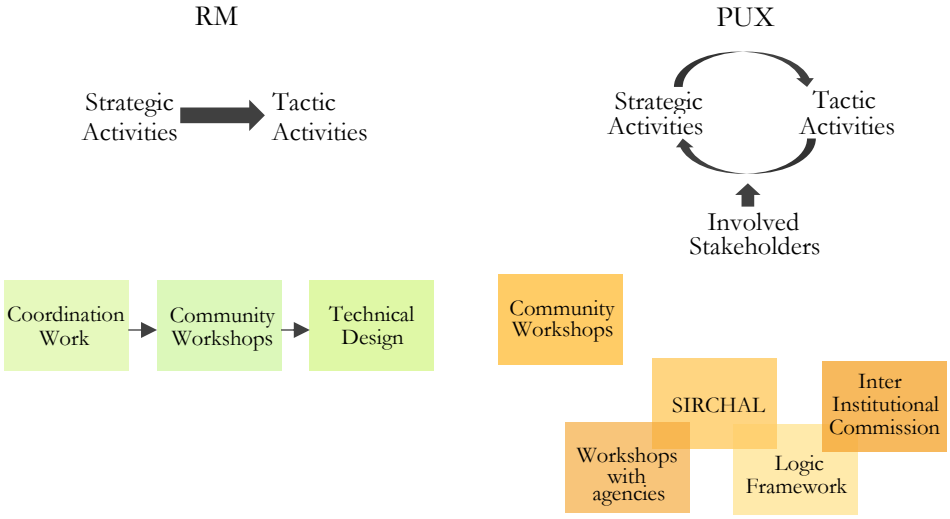

Figure 8.2 Strategic and Tactical Activities
Magdalena River Restoration Project in green and the Project UNESCO-Xochimilco in yellow

In both projects, the community perception was relegated under the academics or incumbents, an issue identified as a risk by Lawhon & Murphy (2011), while projects dismissed their primary strategy. Neither scheme was able to create new patterns and structures in this process. For the Magdalena River project, a Coordination Team was comprised, as the only structure to organise stakeholders and activities, but this was a temporary structure (RM01). The PUX team presented internal problems (PUX05), while PUX04 explained that the project was fragmented as it was a good technical solution, but it was not moving in the social or political aspects. Also, the increasing number of stakeholders challenged the role of the two coordination teams.

As part of the *Operational Activities,* the Magdalena Project focused on a technical solution which was influenced by the regime´s (SACMEX and SEDEMA) know-how. The PUX was oriented to create a governance process to coordinate actors and decision making in the area, but the project faded away as the participants´ support diminished, as they seem unable to share responsibilities and power. Both projects terminated within the governmental-electoral period as they continued relying on governmental support without creating mechanisms for self-support. This stage was characterised by an evident influence of the regime and weaknesses of the projects. The Coordination Team and the Interinstitutional Commission faded away, and no further activities nor structures were created, except for a community-academics network in the Magdalena basin.

The Management Plan in Xochimilco was never implemented, and the Restoration Project significantly changed the Magdalena River producing negative results, but there were some activities related to them afterwards. In the area of the Magdalena River, a CSO proposed a governance tool to safeguard the basin through a Natural Protected Area Declaration while focusing on a smaller area. This proposal was later dismissed due to the political struggles that exist in the local community. The PUX team vanished, but the metropolitan government retook the idea of a Management Unit for Xochimilco. Still, this office is highly influenced by the decision-making of other agencies, as this agency structure changes with every new political period (PUX05; PUX06).

The projects failed to satisfy their design principles and became fragmented. A debate emerges as RM01 defends the position that the Magdalena Project just set the direction lines, as decisions should be continually taken in subsequent stages after the first actions were developed. However, there were no standards on how to achieve minimal concerns, how to involve the population nor set an implementation design to avoid that the river became dry or that the Interinstitutional Commission became an information space. Also, the external support provided by the regime was weak. The Green Plan and Water Sustainable Management Plan for the Magdalena River Restoration, as the Mayor decree supporting the Interinstitutional Commission and the Mexico City Gazette issuing the Management Plan for Xochimilco, failed to create the intended support displaying the weakness of the legal domain. Moreover, the regime continued presenting its common behaviours instead of a disruption to let the projects or IUWM approached be adopted.

The resistance of the socio-technical system

These two projects proposed a transformation in water, natural conservation and other regimes, which is difficult to achieve because there are no mechanisms that allow coordinated actions between two or more system and because of the competitive disadvantage that surrounds this *"new"* regime (Raven & Verbong, 2007). Regime transformation requires the integration of different sub-systems or sectoral regimes in each system (i.e. water supply, sanitation and water treatment, among others) that comprise different combinations of service regimes (i.e. centralised and piped water supply, pipe-trucks and river diversions, among others). However, these are misaligned or *splintered* at the sectoral or regime level, as recognised by van Welie *et al.* (2018). Then, the studied regime comprises different logics related to diverse organisations and actors, especially as it involves different socio-technical systems and splintered regimes. In this case, it is difficult to find the regime boundaries, as the water is provided by the government, while the conservation system is highly interwoven with the governmental structure and the social system. The regime is heterogeneous, supporting Hansen & Coenen´s (2015) claim.

This hybrid regime was studied for each case-study using the socio-technical regime model. This model recognises that the seven sub-regimes interact with each other, assuming they have the same influence in each other, without specifying the relationships or interactions between each dimension. However, in the studied cases, the sub-regime of *Public Policies and Political Power* has a greater influence over the other sub-dimensions, as shown in Figure 8.3.

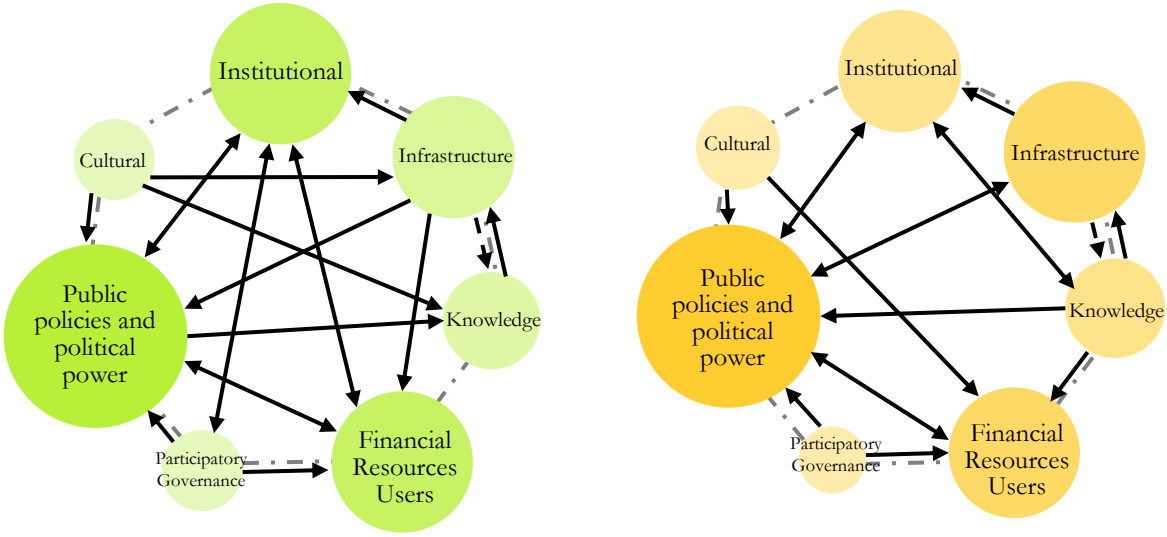

Figure 8.3 Unbalance regime in Magdalena Basin and Xochimilco
The regime that influenced the Magdalena River is shown in green, and the one for the PUX is in yellow.

This *Political Power* dimension seems bigger, creating unbalanced structures. Then, it influences the *Institutional Structure* and the *Financial Resources and Users* dimensions that react supporting the political domain. Infrastructure has enormous importance for the regime, mainly as it was used as the solution for environmental problems. Ezcurra *et al.* (1999) described the extreme faith in technological solutions for water-related problems and predicted that a similar approach was expected to solve environmental

degradation (treatment plants). C*ultural* and *Participatory Governance* dimensions have less influence over other dimensions because the ideas of conservation and public governance are relatively *"new"* for the regime. Hence, the cultural significances and public involvement relate more to the traditional behaviour of the regime and not to the integrated approaches. This regime´s unbalanced structuration acts as a resistance element. Some characteristics are interwoven within complex configurations, making it difficult to recognise them while representing problems for experiments promoted by incumbents. The main problems faced by the two experiments are summarised in Table 8.1.

Table 8.1 Main characteristics of the regime's dimensions that restrict innovations

Sub-regime	Main problems to transitions
Institutional Structure	• Fragmented institutional arrangements, as there is any structure that connects different agencies (or regimes). • Standard practices and agencies´ projects continued, despite commitments to conservation projects. • Agencies behaviour are contrary to what rules (legislation) stated. They support water supply over natural resources conservation showing that water system is a stronger socio-technical system, complicating alignments with weaker systems.
Technologies and infrastructure	• The linear approach is replicated in the studied cases, maintaining the *take-use-waste* vision. • A series of formal and informal interventions altered the natural systems. • The main logic of the infrastructure is maintained, prioritising services supply. The existing infrastructure competes with conservation practices (directly or indirectly). • There is no planning or coordination between different works.
Knowledgebase	• The altered condition of water bodies tends to be disregarded in plans and projects. • Projects minimised the implementation design (how to induce the change) and the capability of the regime to accomplish integrated approaches. • There is no comprehensive knowledge of the transformed regime nor from the whole of Mexico City´s water system.
Financial resources and users	• Projects are temporarily supported financially by the regime, but there are no structures to support them for long-terms. • There are a series of struggles for resources from users and incumbents. • There is no market, and financial resources (revenues) are deficient to cover the expenses to improve the water system. • There is not a market for resource conservation neither; which require the involvement of the government to sponsor conservation programmes or make payments for the environmental services. However, the outcomes of conservation programmes are not visible while cannot compete with urbanisation practices.
Participatory Governance	• No institutional will to involve the community, so engagement programmes tend to be poorly developed. The population has considerable doubts about the reliability and functionality of these programmes. • Inclusive participation is limited as communities tend to be divided, and just some sectors participate. • Limited publicity, so the population is barely aware of projects or conservation practices.
Public policies, political power and struggles	• Inefficient public policy increases power struggles. • Legislation adapts through the time, but without considering the legal background, indicating that legislation is developed in isolation without considering the context. • Struggles have been transferred from the regime and political parties to society, who tend to compete for few resources, such as programmes and grants. • Conflicts are present from the beginning, and they tend to increase as the projects evolved.
Cultural significance	• The utilitarian purpose of water has dominated the discourse of water management. This connotation has pushed the recreational character of both basins replacing the original characters —forestall and agriculture— • Water as a market and a universalised good have restricted changes in water management but do not guarantee a better distribution of natural resources, especially in both studied basins.

Some problems in the socio-technical system are complex and require the involvement of the incumbents to change them, like the natural resource conservation in severely degraded basins and the introduction of financial tools to revert environmental problems. Other problems are related to the structure of the regime (i.e. inadequate rules), which challenge practices integration from different regimes or socio-technical systems. Additionally, it is important to consider the local characteristics that influence transitions and experiments, as the theory suggests (Hansen & Coenen, 2015).

The local context and other variables in transitions

The context of both sites played a fundamental role in the development of the projects, especially the inherent political background described in Chapter 2. This is because the two involved communities are fragmented and divided due to power struggles that are partly the responsibility of the regime´s actors. These actors have divided the community through assigning water access, programmes and grants to some sections of the population and relegating others. These *benefits* were assigned while creating confrontations between different groups, even between *homogenous groups* like the Magdalena Atlitic. This division restricts the implementation of many projects because some people reject them just because others support them (RM07). These conflicts escalate in the Conservation Land, as water management responds to domestic water demands while restricting access to local populations.

Incumbents' utilitarian visions over the surface water in Mexico City compete with the perceptions of the local communities. Water perspectives in both sites are different, but both interlace with land management, the sites history and cultural identity. This is evident in Xochimilco, where water and land management are highly interlaced through the *chinampa culture*. *Chinampas* have a symbiotic relationship with the channels that irrigate the cultivation area, while peasants conserve the channels to maintain their harvest. That was more obvious in the past when most members of the community depended on agriculture. C*hinampas* and the farming culture has been passed down to families from previous generations. The land is private despite that some *chinampas* extension has been declared communal land. On the other hand, the community in the Magdalena River upper basin has a weak identity with its land (RM06). This is because they have had acquired it recently (1975, see p.137), and they share it with the community, which increases struggles related to the *Tragedy of the Commons* (Chapter 4). However, they do not own the land because this forestall land exploitation is forbidden by law, which restricts the owners using it. As a compensation measure, this community perform some environmental works, but without engaging in the decision making about these tasks, causing certain disengagement with their land and its protection.

The current condition of the sites is the result of competitions between different managing visions and the direct influence of the local people who are using the land, especially in the Conservation Land. The existing land-water management in Xochimilco is compatible with IUWM vison. This made the PUX less problematic for the community, especially as this plan proposed to maintain ancient practices and the land tenancy. However, the Magdalena project did not contemplate the Magdalena Atlitic

community´s willingness to have a more active decision on how to manage their land. The Magdalena Atlitic wanted to exploit the wood, but the project barely empowered this community. Hence, the community took small grants and projects related to the Master Plan as the perceived compensations for not having the right in deciding about their land.

Synthesis

These two projects were useful to explain the difficulties in implementing integrated projects due to having limited experience in executing complex approaches that require a flexible approach. The two cases illustrate that projects tend to become fragmented because of the limited evaluation and monitoring of the internal process. At the same time, the regime continues to represent a heterogeneous structure that is difficult to change through a managing approach or governance experiment, especially as the involved incumbents continue to reinforce common behaviours while promoting new alternatives, thus making valuable to focus on the incumbents' role in transitions.

8.2 The role of incumbents in regime transformations

Transition Management literature recommends the involvement of incumbents and governmental actors in governance experiments (Hölscher, Avelino, & Wittmayer, 2018). In these particular cases, change is only possible with the active participation of these actors due to the existing legislation, the high amount of resources required due to the sites´ degradation, the inexistence of niche alternatives and because IUWM approaches require regimes transformation or the integration of different socio-technical systems. However, this created an over-dependency on the incumbents to promote and maintain sustainable projects, which created a series of problems in empowering experiments.

Figure 8.4 represents the dynamics play by the incumbents in the regime and the two projects. During the *Strategic Activities,* the institutional support towards the Magdalena Restoration was high while influencing other sub-regimes, for example the users and the policy. However, at the same time, it was also supporting a parallel project of infrastructure (potabilisation plant). The PUX started with the users and institutional support that eventually increased during the *Tactical Activities* (workshops), creating a reaction from the other sub-regimes. During the *Operational Activities,* the regime involvement started to disappear for the PUX case due to political tensions, but increased back in the Magdalena, as this project was developed within the regime´s institutional logic. Some pressures became not recognisable at plain sight. The dotted lines increased in the *Operational Activities* representing how invisible and political practices influenced the projects, such as the municipal president stopping supporting the PUX due to the political conflict in sharing the UNESCO´s recognition or the increasing struggles with the community for the Magdalena Restoration. Then, during the *Reflective Activities*, the relationship between the regime and the projects broke, limiting the learning or knowledge to subsequent projects.

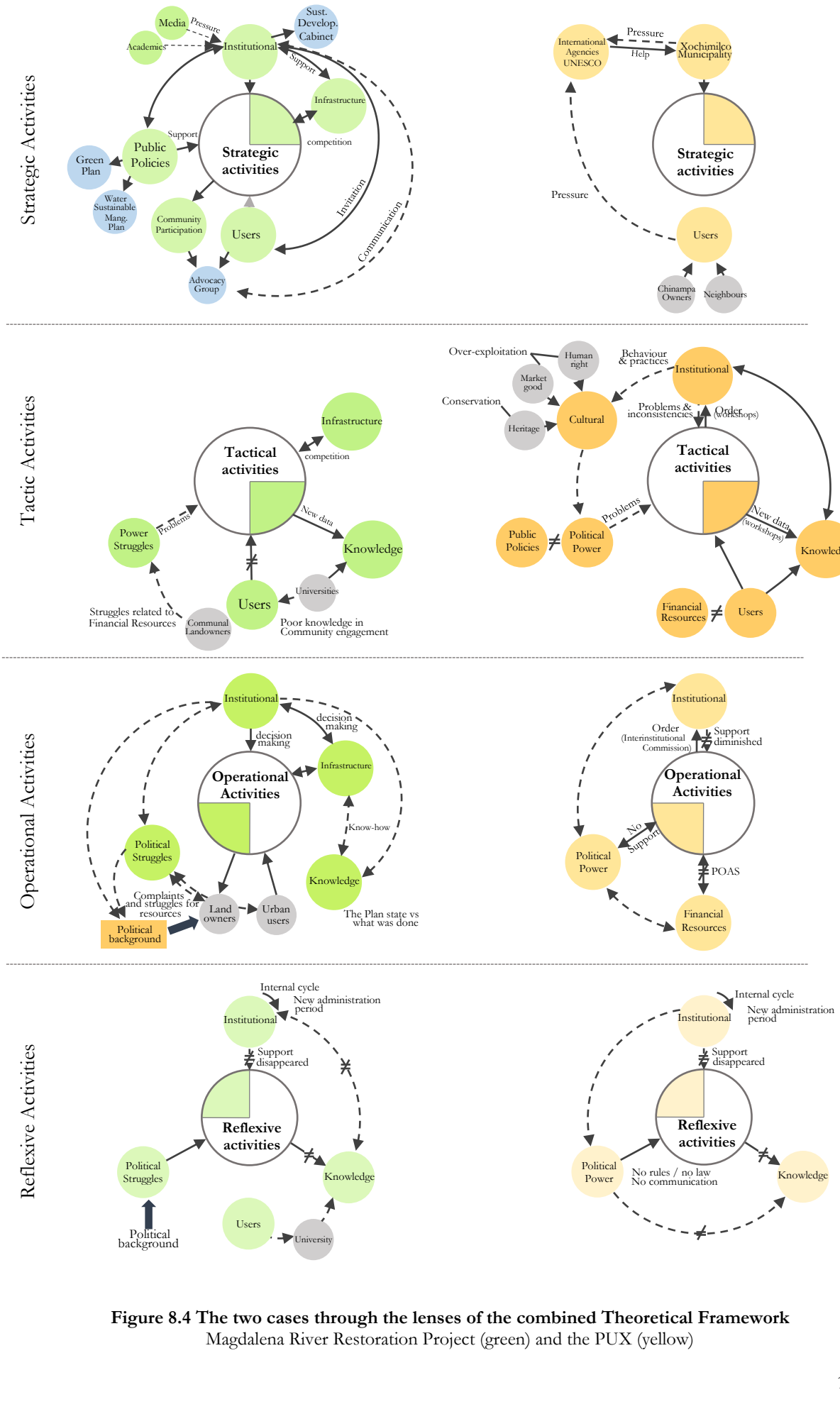

Figure 8.4 The two cases through the lenses of the combined Theoretical Framework
Magdalena River Restoration Project (green) and the PUX (yellow)

This adapted model was useful to recognise how the regime and related regime´s dimensions become more active when incumbents promoted the projects, but then their support faded away. However, incumbents' support was weak from the beginning as they were not involved in the project´s design, which created fragmentation in the process instead of a reconfiguration of socio-technical networks or a learning process (Kelly *et al.*, 2018; Raven *et al.*, 2011; Smith *et al.*, 2010). Hence, the expectations between the stakeholders were not aligned, as the theory suggests (Raven *et al.*, 2010).

Incumbents' participation in the experiments

Despite both projects being based on participation, participation was were intermittent, starting with the incumbents' involvement. In the Magdalena River, the agency with the strongest presence was SEDEMA, which was responsible for the project but delegated responsibility to the Coordination Team. Then, it took some decisions during the *Operational Activities* (i.e. Chimalistac Linear Park), while SACMEX was just involved in the construction of the infrastructure (*Operational Activities*). Xochimilco Municipality was the agency that promoted the PUX, but the municipal president did not delegate a fixed representative of the municipality to deal with this project. "*He appointed…someone to address specific issues…he never designated…a person just to address the issue that was guiding the UNESCO-Xochimilco office"* (PUX04), which denied continuity in this project. The participants' involvement is shown in Figure 8.5.

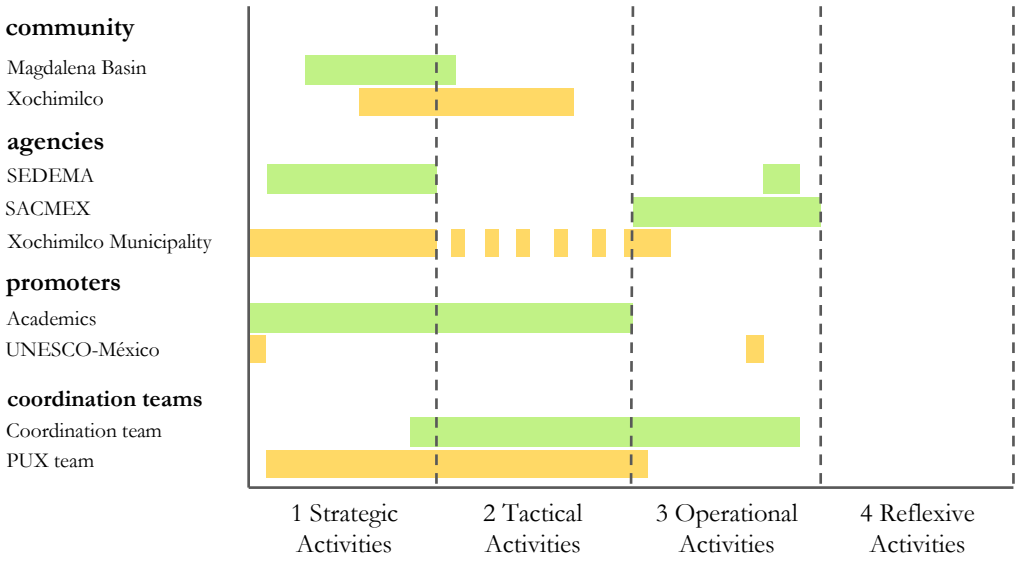

Figure 8.5 Stakeholders' participation
Magdalena River Restoration Project in green and the Project UNESCO-Xochimilco in yellow

The community was involved primarily in the workshops and other activities developed during the *Strategic* and *Tactical Activities*. The academics that promoted the Magdalena restoration remained in the project until the design was finished arguing that it was no their responsibility (RM01). UNESCO-Mexico facilitated the integration of the PUX team, gave them some support during the data collection

process and received the Management Plan (PUX02; PUX04). Overall, the participation was fragmented, the only participants that constantly remained in the development of the project were the two Coordination Teams, but it seems that they were over-involved losing objectivity about the plans, which may bias the process of dealing with other stakeholders (RM14; PUX02).

The Magdalena River Restoration Project was characterised by the fragmentation of activities that ended separating stakeholders into different events. The project design was developed in isolation due to the political issues raised in the *Advocacy Group,* which restricted the creation of networks and knowledge communication. This fragmentation became evident during the *Tactical Activities,* when the relationship between the actors and the whole interaction was through the Coordination Team, restricting the interaction between stakeholders and the possible creation of networks (See Figure 8.6).

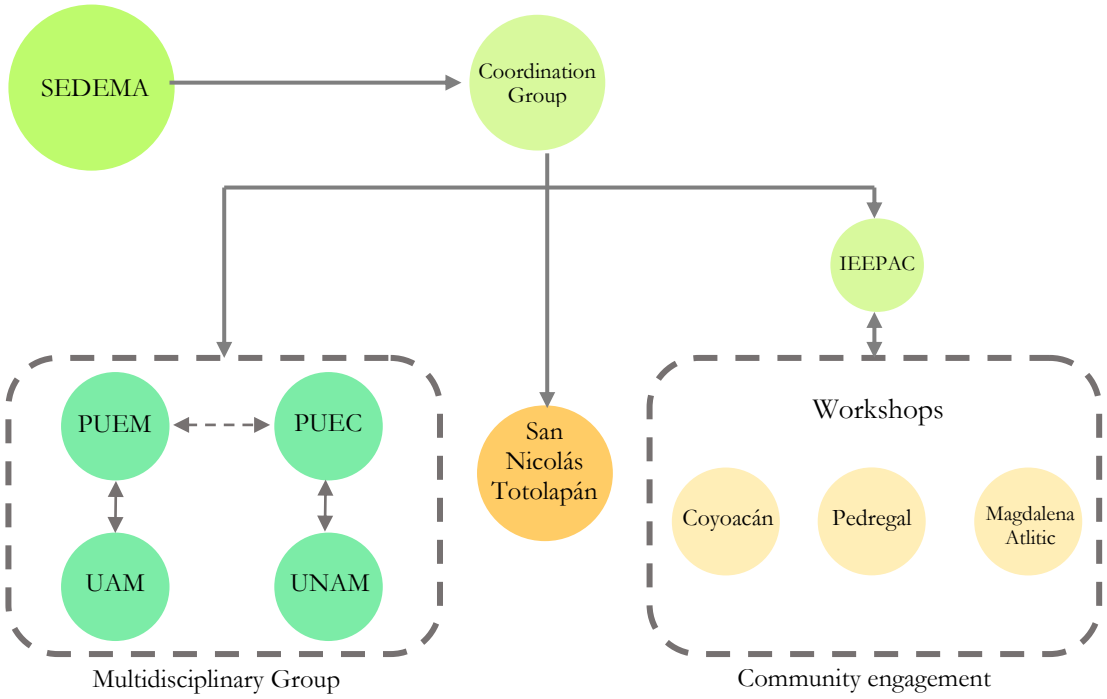

Figure 8.6 Stakeholders involved in the Magdalena River Restoration: Tactical Activities

Then, the academics from UNAM left the project, which represented an abrupt change of stakeholders and a disruption that affected the *Operational Activities* (RM02; RM06), as knowledge, concepts and ideas were not transferred and shared. SACMEX took the responsibility of the hydraulic works, but without being involved in previous activities (RM01).

> *One is the vision of who developed the plan, and another was the vision of who took it. They did what they could and what they were told from the other side, from people who did not develop a plan (RM06).*

According to SMA-GDF and UNAM, (2008), there was a feedback process for the Master Plan, but most of the interviewees state that SACMEX delivered a project that has no relation to this plan (RM04,

RM05, RM12; RM14). The disruption created a knowledge gap that rapidly was filled by regime know-how (i.e. marginal drainage assemblage).

The Project UNESCO-Xochimilco aimed to gather the perspective of everybody involved in Xochimilco and synchronise actions towards the same direction but failed to integrate a large cohort of participants in a single group (PUX03, PUX04; PUX05). This complexity made the PUX team focus on agencies perspective, dismissing community involvement (PUX13). Originally (that is in the *Strategic Activities*), this project involved people from UNESCO-Mexico, the Municipality of Xochimilco, especially the municipal president who was officially behind the project request (Caraballo, 2006), and the people from the PUX team. This project involved people from the metropolitan and federal agencies (secondary stakeholders) who did not participate in the formulation of strategies but were somehow involved in this process due to the site´s regulations.

The number of participants grew considerably during the *Tactical Activities*, involving all the agencies from the three levels of government that intervene in the area. The municipality and the PUX team remained as the main stakeholders of this project, keeping this position through the *Operational Activities* while managing the *Interinstitutional Commission*. This commission required the commitment of the secondary stakeholders, which were the representatives of the principal agencies that worked in the area: ministries of the Federal District (tourism, culture, agriculture, SEDEREC, SEDUVI, SACMEX and CORENADER, among others), ministries from the federal government (SEMARNAT, CONANP, INAH and SEDESOL, among others), all the deputies of the involved municipalities, federal deputies, members of the legislative assembly of the Federal District and the national assembly; representatives of Milpa Alta and Tláhuac (PUX02, PUX05; PUX07). However, Xochimilco Municipality and other agencies´ commitment disappeared when the new political cycle was near. Then, the agency members started to display interest in future political campaigns and let the commission to fade away (PUX03; PUX06).

The AZP was created by the metropolitan government, as it resembles this commission, but it ended working in isolation without having the required influence to join wills of the other agencies. The dynamics of the stakeholder is illustrated in Figure 8.7, displaying how incumbents played a detrimental role in this project (*Operational Activities*), avoiding any commitment towards the site conservation, until the project faded away. Then, agencies continue working in an isolated manner. Eventually, PUX team disappeared, and any of its members remained in the area or comprised the AZP office, showing that there was not knowledge transmission about this project in the area.

This project missed involving the participants from the adjacent municipalities after the Heritage Site grew. This ended damaging the project, as this project continued being the responsibility of just one municipality when it involved three of them (PUX05; PUX06). The three municipalities should have the same hierarchy in the plan design, but this was not done because the plan was already being developed.

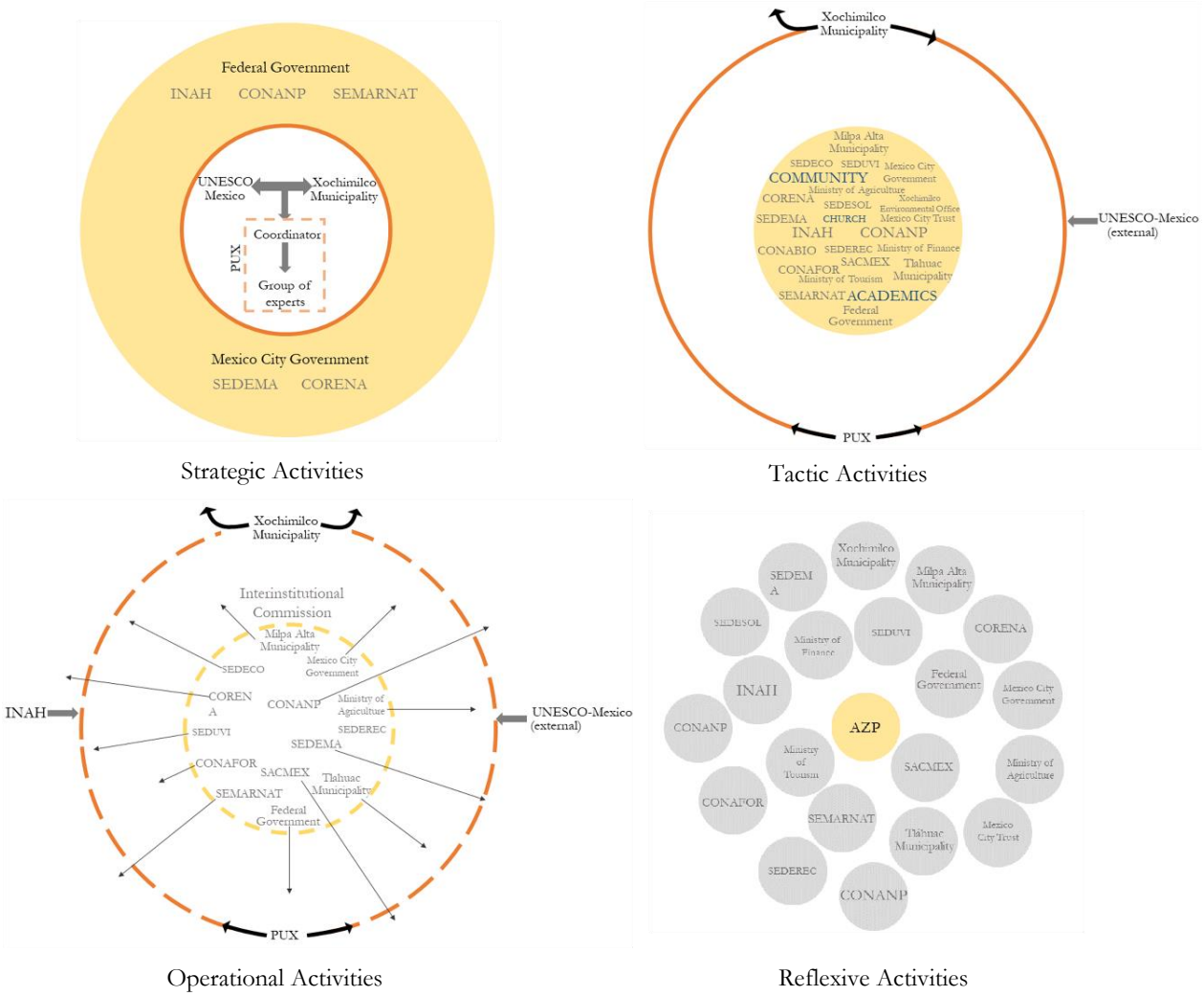

Figure 8.7 Stakeholders involved in the different activities of the PUX

These two cases illustrate how incumbents´ participation contributed to the disintegration of these projects that relied on the regime and authorities support. However, incumbents displayed some opposition to the projects. They perceived the possible coordination between different incumbents as a risk to their positions (as for the PUX) or a risk to the regimes institutional logic (as in the Magdalena River Restoration).

The limited evaluation contributed to the fragmentation of the projects, an issue warned by Mitchell (2006). However, it also permitted the participation disruption, restricting the formation of networks Here, it became noticeable that without people communicating lessons and knowledge, there was no learning process (outcomes), which may have been more important than achieving the projects (outputs), as learning represents a step forward in transition (Kelly *et al.*, 2018). These problems are represented in Figure 8.8, which illustrates that the incumbents highly influence incumbent-led project development as they have the last say (or power) in regards to the project decisions. Then, the lack of internal evaluation created a vulnerability for projects to external decisions (use the regime technological approach or allowed the interinstitutional commission disappearance).

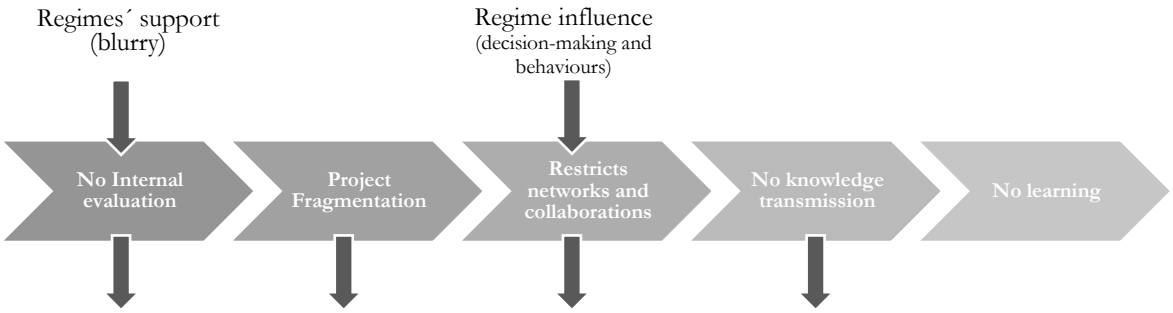

Figure 8.8 Limitations of the projects related to the restricted evaluation and standards

The fragmentation of projects is visible through analysing the coherence of the objectives and concepts. Figure 8.8 displays a series of arrows illustrating that each limitation in the project influenced the internal concepts of the projects. First, it is important to state that the perception of the projects and priorities varies for each stakeholder (RM01; PUX11). Zamora-Sáenz (2014) describes that the idea of recovering a natural water body is vague, so stakeholders can align with this idea, but it is difficult to maintain such alignment. Thereby, the importance of aligning expectations in an iterative process, as highlighted in Transition Theory (Elmustapha *et al.*, 2018; Raven *et al.*, 2010), especially in creating and institutionalising networks that can be defined as niches (Smith *et al.*, 2010). However, the two projects could not align perceptions towards the same objectives because they were fragmented.

The fragmentation that occurred from the *Tactical* to the *Operational Activities* allowed the project to return to the original vision that the Mayor had from the beginning, which was to recover the Magdalena River as an urban river (RM05), disregarding the ideas comprised during *Strategic Activities*, such as the integrated vision of the basin and the river. In the PUX case, PUX13 sees the limited participation as a *business as usual* practice, as this project remained as one of several projects undertaken in the government sphere that do not cascade down to the community. The PUX intended to include everybody´s main concerns, but not everybody desires the same priorities, thereby, the plan lost its focus on conservation. This is somewhat supported by PUX13, who considers that the PUX minimised the conservation of the *chinampa*, despite that it being the core element of the Heritage site declaration. Henceforth, these two cases exemplify the conflicts that emerge around definitions and conceptualisations between alternatives and regime´s institutional logic, also illustrated in the existing literature of rivers restoration (Cho, 2010; Gottlieb & Azuma, 2007; Vierikko & Niemela, 2016). Likewise, they demonstrate how concepts and goals change through time, especially if the project´s standards are weak, restricting the communication and the possibility of maintaining objectives through the whole development process.

Incumbents´ participation in transforming regimes

Regime transformation has been described by Smith *et al.* (2005) as the interplay of resources and power to align pressures and coordinate responses, allowing for changes in the regime towards the desired

direction. In the cases, incumbents distributed financial and other resources to the experiments. However, they displayed limited adaptive responses, such as a sporadic distribution of those resources, a weak legal framework and no interdependency of regime members, which in these cases comprise members from different regimes as they illustrate inter-regimes interaction. Hence, it became a problem related to coordination between incumbents and regimes.

Multi-actor Coordination and Goal Alignment

An IUWM approach requires the coordination of socio-technical systems that interlace with urban surface water management but commonly are managed separately (Williams, 2019), such as water services and natural conservation systems. Hence, this coordination was required for the Magdalena River Restoration Project and the PUX. Cooperation between the two systems should work because laws prioritise the conservation of natural resources over water services. CONAGUA is under the Federal Environmental Ministry or SEMARNAT (Akhmouch, 2012). Therefore, it would be easy to prioritise resources management over services provision or even manage resources and services in a balanced manner. However, water agencies and environmental conservation institutions are extremely separated in Mexico City. Responsibilities and duties are highly controlled and restricted, pushing incumbents to focus on limited scopes and *business as usual* practices. Moreover, incumbents from different socio-technical systems barely work together or even communicate with each other (RM14), which is reflected in the degradation of the Magdalena Basin and Xochimilco (RM02; RM14; PUX05; PUX12), while leaving a gap in water resource management. This is because of diverse objectives from different levels of government, inadequate communication channels between organisms, and inconsistent institutional and legal frameworks, as recognised by the literature on water management in Mexico (Akhmouch, 2012; Garcia-Frapolli *et al.*, 2009; Terregrosa & Jimenez-Cisneros, 2009). Limited communication complicates goal alignments between actors, and inadequate legislation allows a considerable number of overlapping and contradictory programmes and plans, which limits the natural resource protection (Perez-Campuzano *et al.*, 2016).

The problem is that this poor communication and coordination translate into the projects, which because their integrated character are compendiums of multi-actor initiatives. This is more complex in the urban and peri-urban areas because of the high number of socio-technical systems that interact in these areas, such as housing, land management and agriculture, among others. Hence, there is a considerable number of socio-technical systems and a vast cohort of incumbents that need to participate in integrated projects, defining problems and solutions. However, these actors have different priorities that influence the definition process and complicate goal alignment, mainly as incumbents´ behaviours are highly controlled by the agencies´ vision and the existing political contexts (political systems and vested interest).

Visions Struggles

IUWM involves a series of changes in incumbents´ everyday practices, procedures and delivery performances. However, these changes are difficult to achieve as IUWM involves uncertainty, complexities and long-term commitments (Grant, 2016; Sharma *et al.*, 2012), while the regime practices provide certainty, simplicity and short-term responsibilities guided by market-quality principles (Castro, 2006; de Haan *et al.*, 2011). Hence, a risk perception accompanies the IUWM approaches, which is reinforced by a vague logic and blurry rules related to the limited empirical experience and awareness in developing integrated approaches in Mexico. Incumbents perceive problematic IUWM principles and its flexible progress or adaptive management (Foxon & Pearson, 2008; Wong & Brown, 2009). Moreover, incumbents tend to favour approaches and interventions that are familiar rather than venture into unknown and risky ones, so they favour traditional practices that signify visible results. They encourage tangible results or what the literature describes as first-order learning or outputs (such as infrastructure, data and information, among others, Turnheim *et al.*, 2018; Elmustapha *et al.*, 2018), especially those related to the regime vision. In other words, these actors agree with small changes related to improving technology or *incremental innovations* that improve traditional performances (Wehn & Montalvo, 2018). These innovations drive the regime optimisation and reinforce the regime stability, according to the X-Curve of Transitions (Figure 4.3). However, sustainable transitions involve radical innovations, disruptive perceptions (Wehn & Montalvo, 2018), and second-order learning or adapting cognitive frames through the active participation of diverse stakeholders (Turnheim *et al.*, 2018). Hence, there is a need to create social changes that challenge and disrupt the regime, but experiments and projects are probably used to reinforce the regime through incremental optimisation rather than disruption.

The struggles related to the different visions that experiments imply were evident for the Magdalena River Restoration. Here, regime actors took important decisions about the project (i.e., forcing the implementation of the Chimalistac-Viveros Park), because they were embedded in the regime´s institutional logic that continually influenced their performance, and so, the project development (creating a constant pressure). Also, this logic seems to be reinforced by the experiment that was considered a regime's optimisation procedure, so it was implemented within the regime´s institutional logic, reinforcing the use of wastewater treatment plants to fix the system's problems rather than suggest a change in the system (replicating the urban water system and the introduction of Atotonilco waste treatment plant). This became more obvious when the project development was disrupted, the academics-designers left, and the project passed from one agency to another. The knowledge or information successfully transmitted was the one that fitted with the institutional logic, while the voids were filled with the agencies´ know-how. Hence, the Water System assembled pipes in the river, and environmental agencies promoted reforestation programmes and gabion dam constructions following each agency procedures, but contributing further to the fragmentation of the restoration project.

Additionally, this institutional logic is reinforced by the existing inertia of the regime, which is embedded in accomplishing previous responsibilities, such as continue supplying services and spending the

programmed budget. An institutional logic that is stronger in some systems, like the water system that has been prioritised by the Mexican national political structure through years (Banister & Widdifield, 2014; Barkin & King, 1970). This complicates alignments and inter-regime integration, as the water system does not or cannot compromise its power because it needs to continue to provide services that are seen as necessary. Hence, the PUX team was unable to negotiate with incumbents, until the city´s Mayor forced them. Still, this team was unable to negotiate meaningfully with incumbents from several agencies. Despite the intervention of governments to facilitate changes as the literature recommends (Jolly & Raven, 2015; Rock *et al.*, 2009), these are difficult in highly political regimes.

Systems´ political structure and vested interests

Politics and power struggles are inherent to transitions (Avelino *et al.*, 2016), especially when the state is the service (or societal function) provider, as in the case of water supply in Mexico. Hence, the socio-technical system is interlaced within the political structure, which has created a high dependency on political actors and their support to maintain the system, as in this case, the regime relies on subsidies (Martinez & Bandala, 2015; Wilder & Romero Lankao, 2006). Political actors cannot be obviated from any project or process that aim to change the regime. These actors provide legitimisation to innovations (Meadowcroft, 2011; Smink *et al.*, 2015), but they also tend to deviate changes to maintain power and control, as Urban Political Ecology Theory suggests (Ernstson & Swyngedouw, 2019; Heynen, 2013; Lawhon & Murphy, 2011). This political-regime arrangement forces the regime to react to political pressures, towards introducing changes that favour political actors (i.e. sustainable practices or increment water supply). However, it also obligates the regime´s performance to fit into political-bureaucratic structures, making sure the regime deliver tangible results in short (political) terms, complicating integrated projects that require long term commitments.

Additionally, some pressures to maintain the regime are highly interlaced with vested interests, such as to maintain arrangements and power control through distributing grants and services to gain political support (RM04, PUX11). Moreover, sustainable principles and ideas have been commonly used by incumbents to (1) prioritise political-economic interest, like promoting expensive urban regenerations, and (2) depoliticise interventions and make them look uncontested, as Ellis (2011) and (Ioris, 2017) warned. Therefore, it is not surprising that the Magdalena River restoration ended up prioritising certain groups (River Surveillance Committee or some informal settlements that were connected to the drainage), instead of solving environmental issues, as RM10 believes. Furthermore, when dealing with regimes integration, the sustainable principles in one system collided with other socio-technical systems´ vested interest (i.e. promotion of fertilisers to gain political support related to the agriculture system) and some service regimes, as the case of informal service regimes (wastewater disposed into a water body). However, those problems are solved politically, solving short-term interest and maintaining the regime as it is, while any of the services improve. The problem with vested interests is that they are not fully recognisable, and they restrict sustainable practices.

This problem relates to sharing knowledge or information asymmetries about what other agencies do, especially when a considerable number of existing agencies represent more complexity and more knowledge voids about what is happening in the area. Information asymmetries show that agencies perform some activities (*Hidden Actions*) to maintain power, but it is challenging to recognise if these activities are hidden or just uncoordinated. There is considerable *Hidden Information* that relates to agencies perpetuating political behaviours, (corruption and other practices, like as reporting works as finished but when in reality that did not occur), while data is managed according to related motives:

> *….we have to see (Conservation Land) in terms of forest area or hectares loss (due to illegal urbanisation) of environmental services production… (Still), nobody is going to throw into that political suicide….because politically you start hitting many people, who allowed…moreover, who did political favours? (RM09).*

Alternatively, to hide the real results of projects:

> *….on average….the (river) flow has not changed… The problem is not the annual average, the problem is what happened with the dynamics (during) dry and rainy seasons ….. There are ….strong peaks in the rain (season)… masking the loss of water in the dry (season) …. what changes is the hydrological dynamics of the river seasonally, which is serious…. if you have a water management plan (RM06).*

Initially, this research assumed that knowledge voids were allowed in the regime as a political strategy to keep the community unaware and to retain power (decision-making, resources management and distribution). This partly supports Ávila-García's (2016) claim that the Mexican water system is somehow obscure and that obscurity is a means of restricting changes in this system. This assumption turned to be partially true as there is poor communication between the extensive different stakeholders that compete for resources, and limited communication is used to maintain arrangements rather than block other actors´ interests. Whereas incumbents are indifferent in exchanging knowledge, demonstrating that this is more related to the regime's way of working than institutional incapability. However, this has created an unknown path on how sites are managed, which worsens as resource competition goes beyond the local levels, engaging different actors in different scales and even in diverse socio-technical systems (who promote different plans that overlap to each other). This complicates gathering an integrated knowledge of the local basins and the city in general. Knowledge is not consciously used as a power tool to debilitate transitions but definitively damages the regime transformations as it is unknown how the basins are managed and how incumbents, regimes and systems operate, especially when the goal is to achieve an integrated approach.

The changing behaviour of incumbents

Incumbents support changes through the time as there is not a single reaction towards sustainable approaches. They react through a series of different behaviours that vary as the perception of sustainable projects change through time, favouring sustainable practices as long as these benefit them, in the same manner as they favour certain political behaviours (i.e. illegal urbanisation as an exchange for political favours). However, sustainable and integrated approaches will barely provide economic benefits in the short term. On the contrary, sustainability represents high investments and long term commitments (Palmer *et al.*, 2005; Sandusky-Aber *et al.*, 2012), which is perceived as a risk for incumbents´ stability in the long run (uncertainty). So, alternatives will receive some support until they become a risk or a visible competition to the regime (which tend to be during the implementation phase). Hence, the incumbent´s support tends to be temporary and weak. This partly supports Smink *et al.* (2015) claim that incumbents tend to support and reject innovations, even simultaneously. However, this change in rejecting to supporting innovations is not due to a change in the incumbent´s perception of the innovation, which translates from a risk into an opportunity. This did not happen as the studied cases were unable to demonstrate any related benefit as they were rapidly dismissed and could not be developed fully to make incumbents aware of the related benefits. Moreover, the perception changed from an opportunity to risk in relation to the interest of the incumbents who perceive the project as a hazard, especially in the PUX.

Hence, there is an exogenous pressure, the international bodies and social system, which pushes the governmental structure towards support sustainable behaviours. Incumbents tend to respond favourably to this pressure as a survival mechanism to continue receiving funds and power, defending the institutional framework as described by Mostert (2009) and Stead (2014). However, this is just a single and intense pressure. Meanwhile, other smaller and continue pressures push to maintain the regime´s *status quo* (regime´s visions and arrangements, political structures and vested interests).

Incumbents react to the two types of pressures and create responses (such as the studied projects), pressures diminish or increase according to the responses. Regime´s behaviours remain as incumbents respond to external and temporal pressures in a similar manner, through strong but temporal responses (something called symbolic implementation by Casiano Flores & de Boer, 2016). That means sustainable interventions tend to become something visible that creates a political image (Prieto-Gonzalez, 2013), but is shortly articulated to the existing problem. Meanwhile, the other pressures are constant, encouraging incumbents to minimise previous responses or their meaningful intervention in an experiment. This mechanism aims to avoid pressures, conflicts and possible changes.

Additionally, the tools and rules proposed by incumbents generated limited support towards sustainable ventures, as established laws and decrees do not produce a related behaviour that supports them. The results display that there are no mechanisms to make legislative rules functional, which means that legislative rules exist but within a blurry legal framework and a discoordination of procedures that made them dysfunctional while contradicting normative and cognitive rules. Here, it becomes visible

behaviours that encourage sustainable practices, promote experiments, fulfil protocols and develop recommended activities. This can create a perception that there is a trajectory towards sustainability in water management, but in reality, these experiments, protocols and activities do not represent a change because real commitments do not support them. Incumbents take windows of opportunity to show that they are doing something about sustainable problems and then continue *business-as-usual* practices to maintain their *status quo* while reducing possible transition trajectories. This performance is executed to encourage visible actions over solving the real problems in Mexico while continue prioritising standard practices or incumbents´ behaviour patterns. This is reinforced by a series of existing regime´s procedures that enable and support alternative projects, but constrained them in bureaucratic logics that drive them into scheduled times and technical constraints, as warned by Maiello *et al.* (2013) and Sanabria & Hurtado (2017). In the studied cases, this was illustrated by projects being developed within the electoral-administrative changes confining the projects within periods of six years (metropolitan government) or even less (in the case of municipal governments), displaying high embeddedness in rules inherent to systems that dictate how the socio-technical system work. However, this logic diverts projects from IUWM visions, which can jeopardize the implementation of integrated approaches to be performed within divided and segmented traditional regimes´ standards, as recognised as an enormous problem by Zevenbergen *et al.* (2018).

This fact illustrates that funding and new policy are insufficient to protect experiments and innovations, while it is quite complex to create an institutional structure that supports them, at least from the regime level in the developing world, differing to what Berkhout´s *et al.* (2010) suggest. Whereas, there is limited interest in incumbents in embracing alliances or networks (as sharing knowledge) as it seems that incumbents do not gain anything from those activities, but these may compromise incumbents' *status quo*, power and arrangements (which can be informal). Meanwhile, incumbents continue to respond to a series of constant pressures that reinforce the regime structure while supporting practices that deviate external pressures. The regime transformation is blocked by a series of power-political interests and incumbents' willingness to protect the regime, two variables that are interlaced due to the embeddedness of the regime in political structures. Additionally, projects are contained and restricted by power dynamics, which are present in different scales, dimensions and socio-technical systems. Hence, this research can be complemented by studying power dynamics (Avelino & Rotmans, 2011); recognising if the regime is allowing or restricting the projects though delivering resources and power.

8.3 Power in transition processes

Power is inherent to transitions (Smink *et al.*, 2015; Smith *et al.*, 2005). In the studied cases, the experiments emerged to accelerate the transformation that should be happening due to the landscape pressures (international bodies and social system), but these failed due to a series of conflicts. Experiments convey conflicts as stated by Smith *et al.* (2010), representing diverse interests and power struggles for different actors (Hopkins & Schwanen, 2018; Lawhon, 2012). Moreover, these two projects

were endemically conflictive because they emerged as a reaction to external pressures and to ease such pressures over certain political actors. Then, these projects had different objectives for different stakeholders, which represented conflicts about decisions about solutions and costs among others, as the literature describes (Cousins, 2017; Ioris, 2017; White, 2017). However, these conflicts were maintained during the development of the experiment as definitions were not aligned, while escalated as these experiments encouraged systems integration, which involves diverse systems and different visions. This section aims to recognise the trajectory of power, aiming to comprehend incumbents' behaviour, as they delegated certain power to the projects through legislative frameworks, funding and other resources, but reduced the power of the projects through another set of activities (limited publicity and lack of support).

The support of incumbents towards experiments was discontinued or even contradicted the projects, as the interinstitutional know-how subjugated the knowledge of the experiments, which was initially weak due to: (1) poor experience in developing integrated schemes in the country (Interview A), (2) the limited knowledge about alternative practices (Chapter 2), (3) insufficient internal evaluation of the experiments (section 8.2), and (4) because the regime-project power relation that favours the regime and its actors (Foxon & Pearson, 2008; Kelly *et al.*, 2018). Moreover, the involved agencies failed to deliver *power* to the Coordination Teams to align stakeholders around the projects or achieve meaningful commitments from other agencies.

The distribution of power (or resources that contribute to the development of the project) can make evident some behaviours of the regime towards the projects. The power trajectory (Figure 8.9) shows the power distribution and how it failed to have continuity between agencies and actors, especially in be delivered to the community. The main responsible actors or the ones with decision-making power in a grey circle. For the Magdalena River Restoration project, this was SEDEMA, who delegated power to different actors in different phases of the project development while reducing the power of the Coordination Team, which was organising the Magdalena River Restoration Project. It also delivered some decision-making to River Surveillance Committee, which responded more to political interests than involving the community. Still, it is unknown who decided to delegate decision-making power to this group. The PUX show that the Xochimilco Municipality delegated some power to the PUX team, but not enough to negotiate with the agencies that have a similar power to the municipality. Power was delegated to the PUX team momentarily while failing to deliver real decision-making capability to the community. Furthermore, different agencies have different priorities that compete with each other; hence the existing power can be in contraposition. Eventually, the projects faded away as the agencies promoting, financing and delivering decision-making power did not provide mechanisms to translate the

project to the regime nor specification of which agency should be responsible of managing the project once they were finished. This was obvious for the PUX participants (PUX03; PUX06).

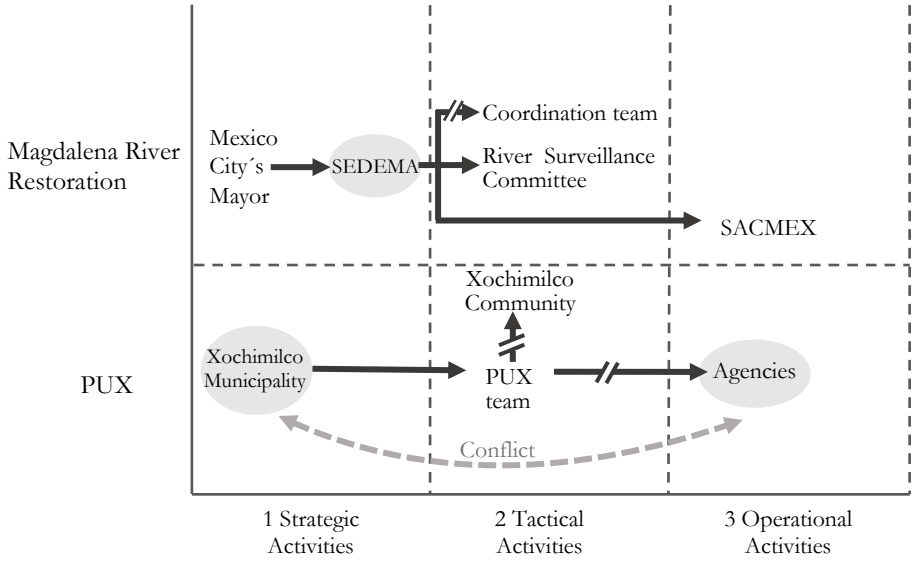

Figure 8.9 Power distribution for the two projects

SEDEMA and Xochimilco Municipality were the main promoters of the projects. However, their support was sporadic, and they intervened to take important decisions about the projects to reinforce their power rather than contributing to the development of experiments. Additionally, the context of the experiments is indeed political due to the vast competitions for resources in Mexico City. People want to exploit the land and natural resources, but there has not been a regulatory structure to balance resource exploitation and related conflicts. Moreover, conflicts have been exacerbated due to the intermission of government entities that favour certain groups and practices to maintain power, as recognised in the literature (Angelo & Wachsmuth, 2014; Rodríguez-Labajos & Martínez-Alier, 2015). This has divided the local communities (RM01, PUX04; PUX08) that tend to see sustainable projects as conflicting entities, as they represent benefits to someone while relegating others. These projects emerged in highly political settings like the Magdalena Upper Basin and Xochimilco, which are characterised by intense competition between agencies and between communities (RM04; PUX03). Hence, the introduction of these two projects represented another entity competing for scarce resources (funding and water), while simultaneously symbolised a possible resource (i.e. possible grants). Therefore, they generated conflicts around them. In Xochimilco:

> *… the urban legend was that UNESCO had arrived at the site loaded with dollars and that it had given multimillion-dollar financing to the municipality to rescue Xochimilco, and that we (PUX team) were the emissaries of those resources (PUX03).*

In the Magdalena basin, such conflict was represented by some actors in the *Advocacy Group* (like NGOs, RM08) and by communal landowner groups of the upper river basin that demanded their inclusion in

the project (Fimbres, 2007a, 2007b). This is a topic highly minimised in the design of IUWM (Furlong *et al.*, 2016b) and the studied cases. However, a series of conflicts were present during the whole experiment development, such as:

1. The competition for natural resources (water) between projects from the same agency is represented in the Magdalena River Restoration Project and the second potabilisation plant.
2. Competition between different agencies from the same regime, illustrating splintered regimes (van Welie *et al.,* 2018) and diverse institutional logics, so the Magdalena Contreras Municipality cut down some trees on the riverbank despite knowing about the restoration project.
3. Struggles that exist between different levels of government and different political party affiliations. The Magdalena River project could not allocate the treatment plant inside Viveros Park due to disagreements between Mexico City´s government and the federal authority who manages that park (RM07).
4. Conflicts in different regime´s scales, as these represent different power. So, decisions taken in a more powerful scale dominates the others, illustrating there is a competition between municipal water users *(chinampa* landowners, communal landowners or *ejidatarios*) and the urban water domestic users at a metropolitan scale. However, the regime prioritises the metropolitan users while undermining the conservation of the studied sites.
5. Conflicts between different systems. The two projects illustrate how environmental conservation conflicts with other systems, such as transport. However, this conflict becomes more intense as the government promotes simultaneously contradicting projects from different systems.

These competitions created problems for the projects, but they are difficult to recognise due to the blurry level division (projects-regime), and because of the regime´s practices become highly embedded in the social system (Ramos-Mejía *et al.*, 2018). Also, political or power struggles are difficult to predict as some conflicts emerge as a response to projects or changes in regular practices (Nadaï & Labussière, 2017), while sustainable and integrated projects can symbolise a risk to the social system (Hess, 2020; Vierikko & Niemela, 2016). However, most of the conflicts seem to represent struggles for the incumbents, as they need to give power to projects and other actors (such as other incumbents, coordination groups, communities or academics) to synchronise resources and systems, making essential to recognise the actor that *has the power of producing a change* (Avelino & Wittmayer, 2016).

Despite Figure 8.9 showing that there were actors responsible for these projects, it was not very obvious who was the authority responsible for them. As the PUX was a municipal project but the commitment in front of UNESCO is at a national level, while other Heritage Sites are managed by the states (PUX15). The city´s Mayor promoted the Magdalena River restoration. He barely intervened in the project, while did not define guidelines or directions for the coordination of multiple socio-technical systems, nor stop the introduction of a second potable treatment plant to redefine it in an integrated project. Moreover,

there was an absence of authority in the areas, as no agency assumed the responsibility for the PUX implementation nor the damages caused in the Magdalena River. Participants describe that CONAGUA (federal water agency) was the main responsible of the Magdalena River as water belongs to the nation (RM07), while INAH (a federal agency) is the primary authority in Xochimilco due to the UNESCO Heritage Site classification (PUX02, PUX03; PUX04). However, these two agencies were not mentioned at all in the development of the projects, besides INAH urging the PUX team to submit the Management Plan. Then, once the political period finishes, the projects became the responsibility of no one. Hence, this is a management issue, as it is unknown the actor with the capability of producing a change.

This research displays that the reframing of policy and the analysis of the actors´ power-motivation to support changes are necessary before any experiment. Whereas, more discussion is needed in regards to power dynamics to understand the reasons for incumbents delivering uneven power to transform the regime.

Power Dynamics in regimes transformations

Avelino & Rotmans (2011) describe that transitions are the dynamical interplay of power between actors. The Magdalena River restoration Project and the PUX show the complexities in empowering different actors such as participants of the Transition Arena, as the difficulties of disempowering actors of the dominant system (i.e. water system) that may control and guide the development of alternatives, minimising the opinion of others. This is because incumbents empower projects as long as they can gain something out of them, such as validation or easing tensions from the landscape, but they are not willing to jeopardise their *status quo*, as Augenstein & Palzkill (2015) describe.

The incumbents respond to some pressures from the landscape, which according to Romero-Lankao & Gnatz (2013), tend to relate to conflicts around access to resources and exogenous burdens. Conflicts around resource access already exist in Mexico (Castro, 2006, 2007). However, these are managed politically to (1) maintain the *status quo* of some citizens (Bojórquez-Tapia *et al.*, 2011), by satisfying needs of urban residents over agricultural ones, and (2) for political gains, like encouraging the interchange of resource accesses and services for votes (Wigle, 2014). This illustrates the notions of Urban Political Ecology about resources being used to reinforce power structures (Angelo & Wachsmuth, 2014; Heynen *et al.*, 2005). Hence, *business as usual* practices are preserved to maintain power structures, restricting any change, such as sustainable transition. Therefore, it is important to reconfigure power structures or stop reproducing behaviour patterns that create privileges for a few people over the expenses of others. This reinforces Ramos-Mejía's *et al.* (2018) claim about incumbents being embedded in ill-functioning institutions and broader behavioural structures, so they restrict changes to maintain privileges, replicating patterns of exclusion towards less powerful actors, which in this case are incumbents from different regimes (i.e. environmental conservation system) and communities. This was visible in the participation programmes, especially in the Magdalena River Restoration, where the project focused on the actors that have some type of power, such as wealthy neighbours from the middle and lower basin, or the ones that

represented vested interest to the regime actors, such as the communal landowners. This project looked for the support of the people that can validate or restrict the proposal, omitting the rest of the population, although they would be the most affected by the project—one of the problems that Transition Management criticisms emphasise (Lawhon & Murphy, 2011).

Also, Avelino (2017) and Avelino & Wittmayer (2016) suggest that different power dynamics relate to the different power of that the actors have. For example, one actor could have power over another actor, one could have more or less power than the other actor, or the power of different actors could have no relation to each other. These dynamics can complement the literature about *Multi-Regime Interaction* that describes the existing dynamics between different systems, which according to Raven & Verbong (2007) can actualise when different regimes (1) cooperate (2) integrate (3) transfer rules, or (4) compete. However, in Mexico City, there is a context of competition between different regimes, incumbents and social actors for resources, which is the result of the decentralisation process that increased responsibilities of the municipalities, but not the means or financial resources to achieve new tasks (Blackman & Sisto, 2006; Van-Lindert & Verkoren, 2010). According to Avelino (2017) *competition* occurs when one actor exercises more power than the other, and its goals limit the other actor goals, as it occurs with the transport system. Additionally, some regimes (water and environmental conservation, among others) are forced to cooperate and integrate resources due to landscape pressures, but incumbents from different systems aim to maintain their *status quo*, arrangements, power and resources, so they restrict regimes´ integration. Avelino (2017) describes this as *antagonism,* as incumbents from different regimes or systems have different power, but they disrupt one another. This disruption happens when incumbents are forced to cooperate. This was more visible in the PUX, where incumbents refused to attend and participate meaningfully in the Interinstitutional Commission, as they see cooperation as a risk to their *status quo* because they need to share responsibilities and power.

This research contributes to Multi-Regime Interaction literature as it illustrates how individual manifestation of power translates into the regime´s power execution while displaying that regimes interact unevenly. This is because incumbents allow cooperation in some aspects but mostly compete or have an antagonist relationship for resources. Hence, regimes cooperation or integration will deal with a phase of competition at an individual scale, as incumbents do not perceive the benefits of coordinate, but they perceive it as a risk. Still, it is important to see if the experiments contributed to creating a niche or a protective space for experimentation.

8.4 Incumbent-led experimentation in the Transition Process

Incumbent-led experimentation illustrates how incumbents deliver power to projects and other actors while altering the regime to allow for different institutional logics (Fuenfschilling & Truffer, 2014). This is difficult to achieve as this type of transition should be accomplished by incumbents, but these actors find it challenging to divert towards non-traditional practices as they are embedded in the regimes´ logic, norms and rules. Moreover, integrated approaches require not only incumbents' willingness in changing

behaviours, but also collaborate with other regimes, socio-technical systems and incumbents that have different logics and strictly separated responsibilities, which complicate inter-systems collaboration through a Transition Management approach. Hence, a policy intervention is necessary to align power between agencies and responsibilities or enable a suitable environment, which has been recognised by the IUWM literature (Ferrier *et al.*, 2009; Hossain & Bahauddin, 2013). However, this policy intervention may be inefficient due to blurry institutional rules that tend to respond to political and regimes interests, allowing inconsistent and varying behaviours of the incumbents as the studied cases displayed. Hence, it becomes crucial to see if niches are created, or other types of actors are empowered, which create another process that supports transitions.

First, it is important to recognise that there may not be previous niches, networks or niche-innovation actors pushing for these projects. In the Magdalena Basin, local NGO´s did not fulfil this role, and the involved academics were not representing pre-existing actors' mobilisations at this specific context (Smith & Raven, 2012), while the community did not represent a niche. In Xochimilco, community members were pushing to conserve the site character but without any idea of how to do it or with aligned expectations (Geels & Raven, 2006). The two projects invited the community to participate and create the support for the Magdalena Restoration Project and recognised the active community participation in conserving Xochimilco. Hence, it can be considered that the projects aimed to comprise niches. However, the manner that community engagement programmes were performed illustrates the limited experience in doing participation programmes (or empowering communities) in Mexico City. These programmes symbolise a radical change and a possible risk for the incumbents, who are not used to communicate with the public. As the cases displayed, incumbents tend to communicate accomplishments and not information about processes.

In the PUX, some community members were included in the Xochimilco´s management decisions for the first time, which made them feel empowered to demand future interventions in the decision process (PUX08; PUX09). The opposite happened in the Magdalena basin, where the people that would be impacted by the project were dismissed in the participation programme. Then, they believe that the participation programme was a ploy to validate decisions made by authorities (RM10, RM11; RM12). Hence, some groups fought back against the project through protests and mobilising resources; for example, the neighbours of Chimalistac used their power to stop the works and invited experts to legitimise their claims. La Cañada neighbours comprised alliances with academics to obtain power and also validate their complaints. These confrontations disrupted the regime´s practices and stopped the project, showing that communities can produce a change in the manners of water management and project implementation. This is because these confrontations challenged the main objective of setting sustainable experiments, which was to ease pressures. Hence, confrontations became important as they destabilised behaviours used by incumbents to reduce tensions. The question is how these pressures can be maintained through time to become constant enough to destabilise the regime, especially as incumbents continued to perform the normal behaviours of minimising conflicts to ease recent tensions

and letting people forget about them. Meanwhile, the community learned that they can be part of the water management and that they can demand to participate in future projects and evaluate processes. They also learned how to get power through alliances with other actors while legitimising their claims, as RM12 claim. Hence, these projects changed the process of how projects are usually developed in these sites, indicating a slight transition towards community participation in the governance of the studied water bodies.

Local niches were not created as a directed process or the result of the experiments. Some networking occurred around the Magdalena River Restoration Project, as this experiment contributed to the formation of alliances between the community and academics in the upper basin. This alliance started as a resistance movement against the project but contributed to comprise a Civil Society Organisation (CSO), as some academics remained working in the basin to maintain the Magdalena River while establishing links with the community (RM01; RM14). Transition Theory recognises that niches are processes in which networks are created by aligning expectations and visions while developing cognitive, institutional, economic and political work (Geels & Raven, 2006; Raven *et al.*, 2010; Smith *et al.*, 2010). This happened when the actors involved pushed to protect the river basin through a Natural Protected Area declaration. However, it seems that this group failed to overcome subsequent political issues inherent to the Magdalena Atlitic community and bureaucratic procures. The projects (the studied river restoration and subsequent Natural Protected Area declaration) have not achieved in empowering the community, especially the marginalised people, as Murphy (2015, cited in van Welie & Romijn, 2018) describes as one of the main flaws of Transition Management. This may be because marginalised people have been historically disregarded or used to maintain power structures (i.e. collisions) in Mexico City. Hence, it is important to continue implementing sustainable experiments that disrupt existing power relationships, through providing spaces for the community and other actors (academics and members of NGOs among others) to create alliances, while been empowered through a networking process.

However, empowering communities can be difficult, as communities highly distrust engagement programmes and many urban renovation plans, as shown in the studied cases (Castro, 2004 *et al.*; Serrano-Rodríguez, 2015). The studied projects demonstrated that a series of intermediaries, such as academics and members of international agencies, can empower these projects or at least create the legitimacy that governmental projects commonly lack. These actors, especially the academics, recognised limitations in their participation as they could not be fully involved in the regeneration of the sites due to work commitments (RM02). Also, the cases illustrate that their position as intermediaries was problematic as they could be overinvolved during the development of the projects, which could in turn, minimise the role of incumbents and other actors (who can comprise niches) in proposing alternatives and sharing power (decision-making capability), and deny the creation of negotiation spaces. As a result, the character of the transition management experiments can be lost. Still, these actors delivered some resources such as trust, knowledge, legitimacy and some neutrality[40] that were very useful to empower

[40] The neutrality of intermediaries is indeed debatable as described by Kivimaa *et al.* (2019).

the projects. Also, these actors helped to empower the community (and possible niches), as when they validated social claims against the Magdalena River project. Thereby, it would be valuable to involve these intermediaries in future interventions while avoiding their over-involvement, so that the objectivity about the experiment would not be lost, and mostly, the provision of their power or reputation is delivered to the dynamic-learning process and not only to the experiment. Intermediaries should be referees and observers who help with turning visions into actions, facilitating cooperation (Kivimaa *et al.*, 2019), enacting others to develop capabilities such as cognitive and collective resources (Roberts & Beamish, 2017), and recording experiences and knowledge in an objective manner (which can be useful for consequent interventions). Mostly, they should ensure that the project targets are outcomes (such as enabling a systemic change and reconfiguring the collective political and institutional order, Turnheim *et al.*, 2018), rather than tangible results that do not fulfil sustainable goals. This represents another arrangement of power and possible struggles.

The two cases show that incumbents use experiments to minimise pressures, but then they diminish the experiments to maintain practices and arrangements, locking-in alternatives. On the other hand, incumbents concentrate on delivering visible results, which validate community participation projects. Aguilar-Barajas *et al.* (2016) claim that incumbents focus on delivering these type of projects as outputs since they tend to concentrate on the number of workshops performed or the number of people involved, instead of the engagement process, the result of these workshops or the formation of networks (or niches). Hence, incumbents do not block nor promote niches, which creates a gap in the manner that participation projects are developed. Intermediaries can take control of how community engagement programmes are developed to empower communities while comprising niches that can regulate and evaluate projects.

Still, the literature recommends active involvement of the community in every part of the project development (van Welie & Romijn, 2018), while communicating the experiment development process continuously (Gil, Calado, & Bentz, 2011), especially in river recovery projects (Scholz *et al.*, 2002). A periodical communication strategy has been previously used to disseminate learning experiences (or outcomes) in achieving collaborative governance in Tongyeong City, South Korea (Ofei-Manu *et al.*, 2018). The constant active engagement has resulted in community empowerment, as Fressoli *et al.* (2014) describe was the case of community building cisterns in dry areas of Brazil. Here, the community gained the power to restrict changes towards replacing cisterns with plastic containers as proposed by the government. Still, this type of empowerment should take it cautiously as Brazilian communities receive direct benefits from the cistern programme, but should be different when the benefits are difficult to demonstrate, as IUWM involve social and environmental benefits that are not very evident (Fletcher *et al.*, 2014). Hence, experiments should also foster institutional innovations, as Silvestri *et al.* (2018) recommend for transitions in developing countries. Other research emphasises the active involvement and support of all the involved stakeholders in the whole development of transition proposal (Gil *et al.*, 2011; Spanger-Siegfried & Dougherty, 2004). This requires the involvement of all the actors within

established protocols and standards, allowing partly separate from the regime´s daily tasks those incumbents involved in the experiments as de-Groote & Backmann (2020) recommend, and empower intermediates through comprising alliances with other actors outside the experiment, such actors involved in parallel projects, as suggested by Usman & Vanhaverbeke (2017).

Other recommendations that emerge in other fields of sustainable transition research, such as Climate Change, support the notion of designing policies that support short-term actions, leading to a step by step approach that is progressively adapting and achieving a long term goal (Faruto & Roch 2020). This prioritises and supports the transition process and the reconfiguration of the socio-technical system, not just supports a goal that may be confined into tangible results (i.e. infrastructure). This approach can be translated into an efficient protocol for transition experiments, where small interventions supported by the corresponding policy can trigger other patterns and projects that lead to the management plan (or a long-term goal). Also, it aligns partially to the regime vision of producing visible results in the short term[41]. This is similar to the intention of the studied projects, but it gives more emphasis on designing and implementing on a smaller scale (or smaller experiments) before focusing on the overall objective of implementing a Management Plan. This can be reinforced by Silvestri´s *et al.* (2018) recommendation on comprising a series of parallel transition arenas to minimise conflicts and allowing more inclusive participation targeting different groups. This approach may allow involving local populations more actively in small projects design, implementation and evaluation, permitting them to decide about the supporting policy, while creating the empowerment that may also create a robust bond with the land and the water, as it seems necessary for some communities, like the Magdalena Atlitic.

8.5 Summary

Transitions towards IUWM implicate a high amount of resources, actors, diverse problems and dynamics, so they require a re-evaluation of responsibilities to facilitate new arrangement involving diverse actors, including incumbents. Incumbent-led projects illustrate transformations as they illustrate regimes´ actors pursuing a change. These changes are embedded in the regime logic and political structures, so they tend to have a particular dynamic as radical innovations are rejected and promoted by the incumbents according to the pressures that threaten the regimes. Incumbents' behaviour towards innovations tends to change, as incumbents balance tensions to maintain the regime structure (vision, political structure, vested interest and power arrangements) while reinforcing behaviours and rules that allowed them to display certain activities towards minimising the pressures. Hence, sustainable projects can be used to diminish external pressures while strengthening the vision of the regime. Sill, experiments can disrupt established process and change the manner that sustainable interventions are implemented.

This research demonstrates that experiments provide advances in the integrated approaches implementation processes, such as encouraging the community involvement in water management

[41] This is similar to the recommendation of aligning niche-innovations to the regime´s language, norms or structures to make it competitive in the regime´s terms (Smith & Raven, 2012).

decision making. Also, experiments can contribute to the creation of networks (possible niches) even if they failed to achieve the desire results. This highlights the importance of evaluating experiment processes as they empower other actors and other processes to ensure that incumbent-led experiments are not developed with the traditional regime´s vision, prioritising networks and knowledge creation (outcomes) as tangible goals (outputs).

Chapter nine

9 Conclusions and recommendations for future work

This thesis describes a sustainable transition trajectory in water management in Mexico City. This case study was useful to illustrate the aspects of incumbent-led transitions in water management in the developing world, especially the dynamics play by the actors of the regimes when dealing with experiments and approaches that differ from the dominant water system. This final chapter addresses three issues. Section 9.1 summarises the main findings of this investigation and answers the research questions established in the introduction, Section 9.2 states the contributions to knowledge in Transition Theory, IUWM approaches in developing contexts and policy in Mexico City. Finally, section 9.3 describes the research limitations and enlists recommendations for future work that may increase this research contribution.

9.1 Conclusions concerning research questions

What is the role of regime-led experiments in responding to transition pressures?

Transition Theory literature describes how external pressures can destabilise dominant structures and open windows to change (Turnheim & Geels, 2012). Whereas, experiments can ease those pressures as they are used to accelerate transitions, by allowing testing of practices and alternatives to water management and creating awareness about what can be improved in the established regime (Berkhout *et al.*, 2010; Torrens *et al.*, 2018). Moreover, experiments can illustrate how the regime and incumbents react to possible changes.

This research illustrates that incumbents promote projects like the Magdalena River Restoration Project and Project UNESCO-Xochimilco as a response to the external pressures, such as complaints from communities, media and some organisations. The Transition Management framework was useful to illustrate how incumbents support projects as long as they eliminate pressures and how projects can become a possible risk to regimes and incumbents if they gain enough power. Literature suggests that regime and related actors divert possible changes (Geels, 2011; Genus & Coles, 2008), but behaviours towards innovations and transitions are more complicated as this research illustrates. Experiments and sustainable proposals tend to be used by incumbents to respond to some pressures, but they are also used to minimise these pressures and the possible changes in the water system. This is because some pressures imply significant disruptive changes unless the regime incorporates some alterations in its structure, as a survival mechanism. Hence, some changes are adopted by the regime and incumbents, who also decides the direction towards changes, which commonly will be towards familiar paths or behaviours. They can provide resources and power to align pressures but not coordinate responses to change the regime, as Smith *et al.* (2005) describe. Incumbents can take the opportunity to use the experiments to promote sustainable practices, but in reality, experiments tend to be performed within the regime logic while reinforcing this logic (or optimising the regime), relegating the radical elements of the innovation. Therefore, incumbents do not coordinate actions to support them. Moreover, they tend to support experiments to pretend they are doing something to solve problems while preventing profound changes in the socio-technical regime.

Incumbent-led experiments or innovations can ease transitions, as Smink *et al.* (2015) describe, but also they can reinforce the regime logic. They can create the illusion that a transition trajectory is taking place when, in reality, is not happening, so experiments can be used to delay transition trajectories. Thereby, the studied cases revealed the importance of an external accompaniment (which can be performed by intermediaries) that revise the evaluation and processes of incumbent-led experiments to keep them as trials that challenge the practices of the regime instead of tools that reinforce them. Also, it is important to review power dynamics towards traditional and innovative practices to create a proper disruption of resources and coordinated responses that allowed regime transformation towards a sustainable direction.

What are the main challenges regime´s actors or incumbents face in changing the regime´s practices and introducing IUWM approaches?

Literature states that incumbents are embedded in the regime logic and rules while they also influence them (Geels, 2011), so they can influence a change in regime logic as Augenstein & Palzkill (2015) suggest. The main focus of this thesis is to understand the behaviour of the actors in the water management of Mexico City because if there will be a change, it will be due to being promoted by incumbents. This is due to the local legislation that involved the water system in any intervention in water bodies. Thereby, the importance of understanding how incumbents face pressures and facilitate or restrict sustainable transitions.

IUWM approaches imply a radical change or a transition in the centralised and piped water system, as it involves technical and institutional solutions that do not align with the established regime as de Haan *et al.* (2015) describe. The introduction of these approaches is challenging despite the inclusion of these in the Mexican legislation (Barkin & Klooster, 2006; World Bank, 2013). IUWM approaches imply a series of changes in several regimes or regimes transformation, while the empirical evidence points out four main challenges that restrict the transformation process:

1. The challenging multi-actor coordination and the alignment of expectations of a large cohort of incumbents. This because of the high number of stakeholders from numerous socio-technical systems and the diverse logics involved, which compromise the creation of negotiation spaces and the formulation of integrated initiatives. Here, different actors have different concerns, prioritise different solutions and tend to discard those proposals that not align with their vision, complicating the introduction of integrated schemes. Moreover, incumbents can agree to cooperate, but in practice, continue developing segmented work due to the inertia of regimes practices and the challenges mentioned below.
2. Incumbents´ willingness to maintaining practices and strategies to reduce risk and uncertainty related to IUWM and other alternative practices. First, IUWM approaches are highly vague due to the lack of knowledge and experience that support the viability of these approaches for the incumbents´ perspective. Second, actors from the regime see unfeasible to stop everyday practices that relate to a series of procedures that are necessary to satisfy the regime´s societal function. This perception creates a restriction even to test alternatives.
3. The political structure in socio-technical systems has created a high dependency on the political actors as the studied cases illustrate. This arrangement embeds the regime in the political process and priorities, while influencing the experiments through a series of processes that confine integrated approaches into traditional bureaucratic and short-term procedures, contrary to what IUWM approaches require.
4. Vested interest and power struggles become highly visible within incumbent led-experiments. Incumbents should distribute power (and resources) to test alternative practices and change the socio-technical system, but in reality, power is distributed intermittently according to

incumbents´ interests. Moreover, incumbents see coordination with other regimes as a risk, so they tend to act in antagonists manner to maintain power and arrangements. This complicates networking, coordination and other alignments required in integrated projects or inter-regime coordination.

Challenges are interrelated while there are not tools to ease coordination and align expectations. Moreover, resources are scarce when dealing with conservation in Mexico City. Hence, the necessity of a new policy to accompany IUWM approaches, facilitating new arrangements and different resources distribution. This policy requires to address the listed challenges systematically a Brown & Farrelly (2009) suggest, allowing more experimentation and the active participation of the actors in aligning expectations and adapting cognitive frames (or second-order learning as stated by Turnheim *et al.*, 2018). Eventually, this will create new rules (cognitive frameworks) that supports IUWM with Mexico City context. This is difficult to achieve, especially when incumbents dominate the transition process and sustainable transition rhetoric.

Do incumbent or regime-led sustainable initiatives contribute towards creating a transition trajectory and the creation of niche- innovations?

Experiments tend to emerge as a response to the inefficient water management or the poor condition of the existing water bodies, which eventually translate into complaints. As a response to existing criticisms, incumbents introduced two projects that proposed management plans that align with IUWM approaches for two degraded sites: the Magdalena River and Xochimilco wetlands. However, generally speaking, the introduced experiments did not produce a change as water management practices remained the same. The most visible changes were the introduction of the community in designing water management approaches (although community engagement programmes are happening, they remain poorly developed in Mexico, Villada-Canela *et al.*, 2019). Both projects opened windows for community participation, which had not happened before in Xochimilco or it became rigid and controlled in the Magdalena Basin, which caused a negative response of the neighbours. In both cases, the projects created a specific reaction in the local population, and the population became aware that they must to be part in the water management, especially in Magdalena Basin where the neighbours witnessed that traditional practices are no longer feasible for the river´s wellbeing. Therefore, the communities will oppose another project unless it comes from or is supported by the community, intermediaries, academics or niches actors, which created a change in the process of how experiments and sustainable projects are developed in the studied basins. Additionally, communities learnt that networks and alliances empower them to demand their inclusion in water management decision making.

Despite the results or outputs obtained, experiments can generate a reaction in the transition course, such as changing the experiments development process or favouring niche creations. This research illustrates that experiments somehow disrupt common practices, especially when more people are aware of the experimental processes. These projects show that it is complicated to generate a change when

there are many stakeholders involved, but it is more difficult when these stakeholders are just incumbents emerged in an institutional logics (even though they belong to different systems), as the perceived changes came from external actors to the regime. This fact demonstrates the importance of empowering different actors besides incumbents (such as intermediaries, communities and other stakeholders) towards creating a niche or a protected space where innovations are tested and expectations aligned. Whereas, this space or group of actors can also become a control group that regulate and evaluate incumbent-led experiments and their implementation process.

Sustainable projects can gain from other forms of water governance, such as the introduction of a network structure or decentralised governance (Van de Meene *et al.*, 2011), which is occurring in Mexico. However, there is limited experience in this domain, as the River Basin Organisations and Councils illustrate (Aguilar-Barajas *et al.*, 2016). Hence, more emphasis should be made in designing negotiation spaces or transition arenas. The cases illustrate that there is a gap in the manner by which these spaces are developed, which may allow a different design approach (and evaluation) for these spaces and a possible more active role of the intermediaries. Also, having different and parallel transition arenas that design different smaller experiments, as suggested by Silvestri *et al.* (2018) to overcome the challenges of bringing together different social actors in Transition Management approaches, may allow testing diverse participation approaches within a single experiment. This requires the participation of intermediaries or other actors (besides incumbents) to empower less powerful actors (communities) while providing legitimacy to the process.

9.2 Sustainable Transitions and Urban Water Management

Contribution to Transition Theory

The original contribution of this research is to expand the research line of power dynamics (previously developed by Avelino, 2017), in incumbent-led transitions. This investigation concentrates on the role of incumbents when promoting transformative projects or a transition trajectory, making evident the importance of power relations in Transition Management processes. This research led to a model adaptation to expand the knowledge related to incumbent-led transitions, as there is not a proper recognition of the role that incumbents play in shaping experiments and regime simultaneously while allowing or restricting changes. This model allows for the identification of political and institutional variables, a combination that has never been made before in incumbent-led transitions in the developing world, illustrating incumbents' behaviours that are not evident in plain sight. Moreover, studying the behaviour of incumbents can illustrate the manner that regimes face transformation processes, and it shows that *Multi-Regime Interactions* are more complex than what Raven & Verbong´s (2007) describe. In fact, regime coordination or integration contains antagonisms and competitions between incumbents that defend political structures and dominant vision arrangements.

Contribution to urban water management

This research illustrates that urban water planning is extremely complicated as it intersects several dimensions and systems, which challenges the introduction of alternative approaches. Moreover, this research validates the need to encourage the networking of stakeholders from different agencies and systems, even those that seem unrelated to water management. Integrated approaches represent multi-regime transformations. However, the coordination of various incumbent is challenging, especially when it becomes impossible to separate political actors from incumbents when the state is the service provider, a characteristic highly common in developing context. Here, the government and related actors are involved in both regime processes and political patterns. This causes them to lose objectivity towards sustainability and the possibility of supervising transition trajectories, which is a common occurrence in the developed world where regime and government are independent structures. Thereby, this research recommends empowering other processes and actors to disempower traditional behaviours and introduce sustainable patterns in water management. Networks (or niche-innovations) can become a control organisation of urban projects (that also encourage a horizontal planning or decentralised water governance) that restrict incumbents in taking most of the decisions within an institutional logic. Whereas, projects and experiments should develop certain robustness through setting an evaluation processes for each project´s stages (planning, design, implementation and monitoring), focusing on the transition process—creating networks, agreements and knowledge—as in obtaining tangible results.

Contributions to the policy in Mexico City

Some regulations at the national level are pushing for a transformation in the regime, fostering the conservation of natural water resources and the introduction of integrated practices. However, this research displays that there is a significant paradox within Mexican legislation (between different systems and scales) creating contradictory practices, leaving sites unprotected and complicating integrated approaches at local scales. This means that a comprehensive work aligning all the legislation in the city is necessary, followed by translating such alignment to projects, programmes and plans. That may be impossible to achieve in the short-term as it would involve a severe depuration work. This research gives some recommendations to align the existing policy.

1. The first recommendation is to trace the water system. This suggestion emerges as the two studied sites are linked, as the Magdalena River currently ends in the Churubusco River, which flows partly to the Cerro de la Estrella plant where the water that maintains Xochimilco's wetlands is treated (Gonzalez-Pozo *et al.*, 2010; Ramírez-Guardado *et al.*, 2013). This fact, only mentioned by one participant (PUX07), highlights the necessity to understand the water flows throughout the whole city. The Magdalena River may need to continue to be disposed of in the drainage to maintain the Xochimilco wetlands, restricting any change in the Magdalena basin.
2. A regional (or national) water management plan would help to synchronise policies, programmes and projects, eliminating institutional barriers and some of the political struggles

related to resources competition. This is already recommended by Aguilar-Barajas *et al.* (2016) who highlight the urgent need to design water programmes with consistency with other programmes at the national level. This management plant should also encourage the introduction of mechanisms that reflect the real value of conserving water resources in Mexico City. This means allocating the real cost of conserving water resources, through recognising the value of water supply, environmental services and the cost of losing surface water bodies, making the system competitive in front of other socio-technical systems.

Also, this research recommends the introduction of policies that support the progressive creation of a long-term policy (or a comprehensive management plan). Local policies should be implemented to support specific actions and projects in the short-term while achieving some visible results (partly aligned to the regime vision). These policies should involve and enhance the active and inclusive participation of the local community towards stating the responsibility of all involved stakeholders (duties, grants, evaluation and sanctions), as periodical revisions to review the outcomes, outputs, and the viability of the policy implemented. Policymakers and incumbents can consider this opportunity to actively work with community members on creating trust and accountability, while ensuring the necessary institutional and regulatory environment to steer incumbents' behaviours towards participatory governance.

9.3 Limitations and recommendations for future work

The result of this thesis aims to cause an impact on how the integrated water management approaches are implemented, especially in Mexico City. However, some consideration has to be taken as the results are related to a specific context and particular local characteristics. This research recommends strengthening social actors and networks to create, in some way, a group that regulate incumbents´ decisions and projects. The intervention of social actors in creating networks and possible niches should be considered carefully. Social actors can display some interest in creating a change, but in these cases their involvement tends to last as long as they create reactions or tangible results (RM12; PUX11), having intermittent participation similar to the incumbents. This happens despite the high distrust in incumbents and powerful actors in Mexico City. Hence, more consideration should be done in understanding historical dynamics and contextual influences in local social systems. Additionally, it is recommended to contribute these research findings with incumbents' viewpoints about the pressures and challenges they face in introducing innovations, focusing on the manner on how they can coordinate responses and support experiments meaningfully.

Also, some issues emerged during the analysis using the adapted model (Chapter 4). This model was useful to distinguish activities, strategies and power used by incumbents to influence projects. However, this model was inefficient in illustrating the particularities of the studied regime, due to the complexity of the *emerging* socio-technical system and its unclear boundary, causing complication in recognising incumbents and separating them from the political actors. Hence, it would be useful to complement this model to illustrate conflicts through different scales and different socio-technical systems, the multiple

actors and their different roles within the regime by using a system dynamic model. Additionally, there are several issues related to this research that deserve further investigation. The main issues that require further research to better comprehend water management transitions in Mexico City are detailed below.

Regimes and socio-technical systems

This thesis focus was on the water system regime and its interaction with the environmental protection regimes. However, the outcomes of this research highlight the necessity of understanding the complicated relationship between different regimes and systems that exist within Mexico City, especially on how regimes complement each other (i.e. water system and food system in the case of Xochimilco) or how regimes restrict each other (i.e. transport system and conservation system). This can be complemented with planning and related evaluation theory (Oliveira & Pinho, 2010).

Projects and niche-innovations

Here, two issues emerged: (1) the need to improve the Transition Management framework and to assign evaluation to the projects´ development (or to each TM stage) while recognising the diversity of stakeholders that need to be involved in it, and (2) the importance of recognising different processes and variables that affect projects and transitions from different scales.

First, Transition Management framework can be complemented by Mell *et al.*'s (2017) evaluation framework, which regards the analysis of the national, regional and municipal existing policy and how it affects the implementation of projects. Oliveira & Pinho (2010) recommend setting the evaluation design within the planning process from the beginning, but considers that it is difficult to evaluate or even define intangible results (i.e. learning or social equity). Still, it would be necessary to understand the project institutionalisation (structure and empowerment). TM can be complemented by using Phillips, Lawrence & Hardy´s (2004) framework that illustrates the relation of texts, discourse and actions in the institutionalisation process. This framework can help to incorporate the viewpoint of different stakeholders in the analysis.

Second, this research describes the resource competition from different scales, the incompatible legislation and institutional structures between different government levels and the interconnection of different systems and multi-regimes, which illustrates an *Urban Sustainable Transition* (Grin *et al.*, 2017). More research using a multi-scale approach and a polycentric approach could be beneficial to recognise urban sustainable trajectories in Mexico City. The polycentric approach identifies that different actions at multiple-scales are the most effective manner to achieve sustainable outcomes (Ostrom, 2014). The term of multi-scale is used to define homogeneous spatial and temporal dimensions that comprise a heterogeneous area (Nikezic, Trajkovic, & Milovanovic, 2020), allowing the recognition of different projects at different scales (housing, neighbourhood, municipality, etc.) (Ostrom, 2010). This study can be complemented with other experiments in the sites that interlace with water management, such as the

participatory monitoring for the Magdalena River promoted by RM05 or some projects that aim to improve land and water quality in Xochimilco (PUX13). This approach recognises the spatial and physical characteristics (Mell *et al.*, 2017) as the varied social groups that are affected differently by projects (Manaugh, Badami, & El-Geneidy, 2015) or contribute to transitions differently (Frantzeskaki *et al.,* 2017), especially to trace the complexity of the peri-urban interface.

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Appendixes

Annexe A

Invitation to participate

LONDON'S GLOBAL UNIVERSITY

UCL

¿Es posible la sustentabilidad del agua en las ciudades? Conceptos, implementación y obstáculos para introducir infraestructura verde en la Ciudad de México

University College London está consciente sobre la necesidad de las ciudades de ser sustentables. Por esa razón, UCL está trabajando en diversas metodologías para lograr cambios sustentables en zonas metropolitanas. Siguiendo ese objetivo, me gustaría invitarte a participar en mi estudio de investigación. Éste explora la implementación de alternativas en el manejo del agua en México. Para ello, es necesario reconocer los proyectos existentes y cómo se relacionaron a los diferentes elementos sociales y ambientales. De ahí que se requiera el conocimiento de expertos con experiencia en proyectos sustentables.

¿Por qué ha sido invitado?

Usted ha sido invitado a participar porque estuvo relacionado con el diseño, planeación o implementación de un proyecto que busca la sustentabilidad hídrica en México. Su experiencia nos puede ayudar a entender mejor el proceso de implementación de dicho proyecto, así como las fortalezas y deficiencias de éste. Estamos interesados en sus respuestas basadas en su experiencia y perspectiva profesional.

¿Cómo puede participar?

Si decide participar, un estudiante de UCL ira a su oficina y le hará una entrevista que durará 60 minutos aproximadamente. Si desea participar por favor envíenos un correo electrónico confirmando su deseo de ser entrevistado a:

¿Qué sucede con sus respuestas y datos?

La información que recopilamos es confidencial. Los resultados publicados nunca contendrán datos personales con los cuales un individuo pueda ser identificado. No se mostrará información personal sin su previa autorización. La información que usted proporcione será juntada con la de otros entrevistados para recrear varios casos de estudio e identificar los mayores problemas que enfrentan los proyectos sustentables en México. Sus datos personales serán protegidos por la Ley de Protección de Datos de 1998 del Reino Unido.

Gracias por participar

Fernanda García Alba G. Estudiante de PhD

University College London, Gower Street, London WC1E 6BT
Tel: +44 (0)20 7679 2000
email@ucl.ac.uk
www.ucl.ac.uk

Annexe B
Interview Guide

Civil, Environmental and Geomatic Engineering

INTERVIEW

Interviewee name	
Date and time	
Place	
Interviewer	
Other people present	

1. How were you involved in the project?
2. Can you describe how did the project start?
3. Can you describe what happened? Can you describe the project's development?

   3.1 Was any other actor involve and how? (Government agencies, NGO's, etc.)

   3.2 Which barriers do you think the project had to overcome?

   3.3 When did those barriers show up?

   3.4 How did the barriers impact the project (succeed or failed)?
4. How is the project now?

   4.1 Why do you think that happened (succeed, failed or not been implemented)?

   4.2 Are there are new changes and new barriers to overcome?
5. What would you change about the project?

   5.1 Internally (i.e. project implementation work)?
   5.2 Externally (i.e. government agencies)?
6. Is there something else you would like to say?

a. Who else do you think would be necessary to interview to know more about this project?

b. Later, a small questionnaire will be sent to participants to rank possible solutions to implement sustainable projects. Would you like to receive the questionnaire?

□ Yes □ No

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ENTREVISTA

Nombre del entrevistado	
Fecha y hora	
Lugar	
Entrevistador	
Otra persona presente	

1. ¿Cómo usted estuvo involucrado en el proyecto?
2. ¿Puede describir cómo inició el proyecto?
3. ¿Y qué paso después? ¿Puede describir el desarrollo del proyecto?

   3.1 ¿Estuvieron otros actores involucrados y cómo se involucraron? (Dependencias de gobierno, ONG, etc.)

   3.2 ¿Qué obstáculos tuvo que superar el proyecto?

   3.3 ¿Cuándo se presentaron esos obstáculos?

   3.4 ¿Cómo impactaron al proyecto (éxito o fracaso)?
4. ¿Cómo está el proyecto ahora?

   4.1 ¿Por qué cree que el proyecto llego a ese estado (éxito, fracaso o no implementado)?

   4.2 ¿Han habido cambios o han surgido nuevos obstáculos que superar?
5. ¿Qué cambiaría del proyecto?

   5.1 Interno al Proyecto (ej. grupo, implementación)

   5.2 Externo al proyecto (ej. Participación autoridades)
6. ¿Hay algo más que le gustaría decir?

a. ¿A quién más cree que sería necesario entrevistar para saber más sobre este proyecto?

b. Posteriormente, un cuestionario será enviado a los participantes para clasificar las posibles soluciones para impulsar proyectos sustentables. ¿Le molestaría recibir el cuestionario?

□ Si □ No

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Annexe C
Information Sheet

Civil, Environmental and Geomatic Engineering

Information Sheet for: Is urban-water sustainability possible? Concepts, implementation and barriers to enhance Integrated Urban Water Management in Mexico City

I would like to invite you to participate in this research study. You should only participate if you want to. Before you decide whether you want to take part, it is important to read the following information carefully. Please ask, if there is anything that is not clear or if you would like more information.

This study has been approved by the UCL Research Ethics Committee (Project ID Number): 7327/001

Contact details:

Principal Researcher: Sarah Bell
Address:
Telephone:
Email:

Researcher: Fernanda Garcia Alba
Email:

Research Details

Water management in Mexico City is a complicate topic. The complex processes that are involved in supply and dispose water seem incapable to deal with the risk and the uncertainty from climate change events, such as draughts and floods. It seems clear that Mexico needs to change its strategies on water management, unfortunately this change is limited. This research study projects that encouraged the introduction of sustainable practices, in order to understand pros and cons of this kind of projects, as well as the main constraints they face.

This research is based on interviews with people who have been involved in sustainable projects, gathering the views of neighbours, government agencies, academia, NGOs and the community about these projects' implementation.

If you agree to take part in the Interview process, you will be asked if you would like to be contacted later to answer a survey. Your participation in this study will not be affected if you decide you do not want to be contacted in the future.

Interview process

You will be required to take part in an interview that will be approximately 60 minutes long. You will be asked about your relation with the project and the main problems that you think had the project. All this from your point of view.

If you decide to take part, but then find any question or activity discomforting, you are free to withdraw without giving a reason.

Outcomes

The interviews will reveal the causes that impacted a water sustainable project. By participating in this research you can receive information about the different perceptions about the project and the problems it had to face. If you want to know the results of this investigation please contact the researcher.

Published results must not contain personal data by which an individual can be identified. Your personal data will be protected under Data Protection Act 1998.

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Información sobre su participación en: ¿Es posible la sustentabilidad del agua en las ciudades? Conceptos sobre la implementación y los obstáculos para introducir infraestructura verde en la Ciudad de México

Me gustaría invitarte a participar en esta investigación. Sólo debe participar si así lo desea. Antes de decidir si desea participar, lea cuidadosamente la siguiente información. Por favor, pregunte si hay algo que no está claro o si desea más información.

Este estudio ha sido aprobado por el Comité Ético de Investigación de UCL. Número ID: 7327/001

Detalles de contacto:

Investigador principal: Sarah Bell
Dirección:
Teléfono:
Correo electrónico

Investigador: Fernanda García Alba
Correo electrónico:

Detalles de la Investigación

El manejo del agua en la Ciudad de México es un tema complicado, debido a que los procesos para suministrar agua potable y desalojar la residual parecen incapaces de hacer frente a los posibles eventos relacionados al cambio climático, como sequias e inundaciones. Es indudable que México necesita cambiar sus estrategias sobre el manejo del agua, lamentablemente este cambio es limitado. Esta investigación estudia proyectos que alentaron la introducción de prácticas sustentables en el manejo del agua, para comprender las limitantes que rodean a este tipo de proyectos.

Esta investigación se basa en entrevistas con personas que han estado involucradas en proyectos sustentables, reuniendo las perspectivas de vecinos, organismos gubernamentales, academia, ONGs y de la comunidad en general sobre este tipo de proyectos.

Si usted decide participar en esta entrevista, se le preguntará si le gustaría ser contactado posteriormente para contestar una encuesta. Su participación en este estudio no se verá afectado si decide que no quiere ser contactado en el futuro.

Entrevista

Se le pedirá participar en una entrevista que durará 60 minutos aproximadamente. Se le preguntará acerca de cómo se relaciona con el área de estudio y sobre los principales problemas que usted considera tuvo el proyecto. Todo esto desde su punto de vista.

Si decide participar, pero le molesta alguna pregunta, usted es libre de retirarse de la entrevista sin dar una razón.

Resultados

Las entrevistas darán a conocer las causas que impactaron al proyecto. Al participar en esta investigación usted puede recibir información sobre las diferentes percepciones sobre dicho proyecto y los problemas que éste tuvo que enfrentar. Si desea conocer los resultados de esta investigación por favor póngase en contacto con el investigador.

Los resultados publicados no contendrán datos personales. Sus datos personales serán protegidos por Ley de Protección de Datos de 1998 del Reino Unido.

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Annexe D
Consent Form

Civil, Environmental and Geomatic Engineering

Consent Form for: Is urban-water sustainability possible? Concepts, implementation and barriers to enhance Integrated Urban Water Management in Mexico City

Thank you for your interest in taking part in this research. If you have any questions arising from the information sheet or the explanation given to you, please ask the researcher before you sign the consent form.

This study has been approved by the UCL Research Ethics Committee (Project ID Number): 7327/001

The purpose of this document is twofold:

- Consent to a record interview
- Describe the conditions agreed regarding the use of recordings and detailed notes and quotes resulting from this interviews

The interviewee/participant agrees as follows:

I agree that the research project named above has been explained to me to my satisfaction.

I consent to participating in a recorded interview. I have been made aware of the procedure to be followed.

I understand I may withdraw from the process at any time without penalty.

I understand my name will not be disclosed without my permission.

I understand that I am giving the interviewer the right to use and make available the content of the recorded interview in the following ways:

- Reputable scholarly research
- Use in educational establishments including use in a thesis
- Public lectures or talks
- Use in publications

Date of recording……

Participant

Signed: ……

Print name:……

Occupation:……

Address:……..

Postcode:……..

Email:……..

Interviewer

Signed:……

Print name:……

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Formulario de consentimiento: ¿Es posible la sustentabilidad del agua en las ciudades? Conceptos sobre la implementación y los obstáculos para introducir infraestructura verde en la Ciudad de México

Gracias por participar en esta investigación. Si usted tiene alguna pregunta generada por hoja de información o la explicación del investigador, por favor hágala antes de firmar el formulario de consentimiento.

Este estudio ha sido aprobado por el Comité Ético de Investigación de UCL. Número ID: 7327/001

El propósito de este documento es obtener:

- Su consentimiento para grabar su participación en una entrevista
- Describir el uso de las grabaciones, notas detalladas y citas que resulten de su participación en la entrevista

El participante acuerda lo siguiente:

Estoy de acuerdo que el proyecto de investigación se ha explicado a mi satisfacción.

Doy mi consentimiento para participar en una entrevista y se me ha informado del procedimiento a seguir.

Entiendo que puedo retirarme y dejar de participar en la investigación en cualquier momento sin sufrir algún tipo de penalización.

Entiendo que mi nombre no será revelado sin mi permiso.

Entiendo que estoy dando al entrevistador el derecho a utilizar el contenido de la entrevista de las siguientes maneras:

- En una investigación académica de buena reputación
- Uso para fines educativos, incluyendo la el uso de éstos para una tesis, conferencias públicas o pláticas.
- Uso de las publicaciones académicas

Fecha de grabación .....

Participante

Firma: .....

Nombre:.....

Ocupación:.....

Dirección:.....

Código postal:.....

Correo electrónico:.....

Entrevistador

Firma:.....

Nombre:.....

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Annexe E

Example of an Interview Sample

0:04	***How were you involved in the UNESCO-Xochimilco Project?***
0:10	Well, I was hired by the UNESCO office in Mexico ... (*he was thinking*) ... it seems….it was in 2005 when we worked on that project. I think that this project had started a few months ago. It already was some progress, and they invited me as an independent consultant. I was working at that time for the University Program of Metropolitan Studies, there at UAM Xochimilco. And through…: the graduate _____ they contacted me, proposed an interview. We met two, three times, we looked at the scope of the proposal that they wanted me to develop, and finally, we reached an agreement for me to join that work team.
1:21	My participation in the project consisted in _____of the project. Well, we generically call it Project UNESCO-Xochimilco. So, it was up to me to do that and also… to build the conceptual model of a_____, which would later give rise to a _____ system.
1:54	So what we did…..was to establish a work agenda, which was made in regular meetings to review progress. Of course, before that, I submitted a proposal to the UNESCO office. A proposal, a kind of terms of reference to know what the scope of the work would be. They accepted it, and accordingly, I was working on it…gathering information from many different sources…doing fieldwork and reviewing some data, reconciling many layers of information. As you probably already know…we do not have a culture to be ... meticulous with the gathered information, because each layer of information had certain characteristics. We had to do a very important standardisation job, correct geographic projections. In short, all the work that this entails, and which was closely followed by_____. I worked closely with her, and of course, with who was the leader of the project at the time, Ciro Caraballo.
3:43	We had inter-institutional meetings with Ciro, seeing the progress on different work fronts. They were also useful for reporting. First, what we had achieved from each work team, and also, look at the difficulties that we were facing. It was a practical one year job. Well, it has been a long time, so I do not remember.
	….
4:20	*Can you talk about those difficulties?*
4:22	First, the availability of information, because there were some features of the information that at that time were becoming available to the public…..The situation was not like now….Now you enter the INEGI page, and you can download information without any problem. You had to request it before, something more complicated.

0:04	*¿Cómo estuviste involucrado en el Proyecto de UNESCO-Xochimilco*
0:10	Bueno, a mí me contrato la oficina de UNESCO en México… *(reflexión)*… me parece que fue en el año 2005 cuando se trabajó en ese proyecto. Entiendo que ese proyecto había comenzado algunos meses atrás. Ya tenía algunos avances y me invitaron como consultor independiente. Yo estaba trabajando en ese momento para el Programa Universitario de Estudios Metropolitanos, ahí en la UAM Xochimilco. Y a través de….de la licenciada _____ me contactaron, me propusieron entrevistarnos. Nos reunimos dos, tres ocasiones, miramos cuales podrían ser los alcances de la propuesta que ellos querían que yo desarrollara, y finamente, llegamos a un acuerdo para que me incorporara yo a ese equipo de trabajo.
1:21	Mi participación en el proyecto consistió en_____del proyecto. Bueno le llamamos genéricamente proyecto UNESCO-Xochimilco. Entonces, a mí me correspondió hacer eso y además….armar el modelo conceptual de una_____, que diera lugar posteriormente, a un sistema_____.
1:54	Así que lo que hicimos a partir de eso fue establecer una agenda de trabajo, que pues se conformaba por reuniones periódicas para revisar avances. Por supuesto antes de eso yo entregue una propuesta a la oficina de UNESCO. Una propuesta, una especie de términos de referencia para que supiéramos cuales iban a ser los alcances del trabajo. La aceptaron y conforme a eso estuve trabajando en eso, estuve reuniendo información de muy diversas fuentes, estuve haciendo trabajo en campo revisando algunos datos, conciliando muchas capas de información. Que como seguramente ya sabes, dado a que no tenemos una cultura para ser…meticulosos con la información que vamos generando, pues cada capa de información tenía ciertas características. Tuvimos que hacer un trabajo de homologación muy importante, corregir proyecciones geográficas. En fin toda la talacha que esto conlleva, y quien le daba seguimiento muy de cerca al proyecto pues era _____. Con ella trabajaba de manera muy cercana, y por supuesto, con quien era el líder del proyecto en ese momento que es Ciro Caraballo.
3:43	Con Ciro teníamos reuniones interinstitucionales, en donde veíamos avances en los diferentes frentes de trabajo. Y también nos servían para reportar. Primero, que habíamos logrado desde cada equipo de trabajo, y luego también mirar, las dificultades que íbamos enfrentando. Fue un trabajo prácticamente de un año. Bueno, ya tiene mucho tiempo así que no recuerdo.
	….
4:20	*¿Podrías hablar de esas dificultades?*
4:22	Primero, la disponibilidad de la información porque por supuesto que había algunos rasgos de información que en ese momento comenzaban a estar disponibles al público. Porque la situación no era como ahora. Porque ahora tu entras a la página de INEGI y puedes bajar información sin ningún problema. Antes tenías que solicitarla, algo más complicado.

Annexe F

Example from the matrix sample: deductive approach.

Regime dimension	**Technologies and infrastructures**				
Characteristics	**Hydraulic work**	**Formal technical standards and infrastructural arrangements (Conservation)**	**Informal technical standards and infrastructural arrangements**		**Knowledge (related to the technological standards)**
	Potabilisation Plant		**Unregulated Activities**	**Informal Water Extraction**	
RM01					*... it was not the first time that....it was proposed to recover it (the river).... previous initiatives had existed circumscribed at the municipal level. Projects are done with the basic and historical logic...which glimpses recovering the rivers of the city, getting peripheral drains...*
RM02		*There are reforestation programmes... ... gabion dams….. construction programmes, productive programs (trout farms, ornamental plant production) ..... endless technical actions, which are much disorganised. So disorganised, that currently is that disorder is visible and the river tends to lose its quality not only aesthetic but functional in terms of the organisms that should be there*			
RM03			(IN DYNAMOS PARK) *(The water) is already polluted, because at the time is crystal clear, (they put) PVC tubes and extract it to prepare food in ... the cabins. The wastewater, water they used, is thrown through buckets back to the river... or they throw it nearby, but the run-off will take it back to the river.*		
RM04	*They put a potabilisation plant...but for a long time, they could not use it because there was not enough (water) ... That is, from what they used on the first upstream (potabilisation) plant, there was not enough amount of water that reaches to the other plant...They should have done it differently for rainy and for dry seasons*				*The Water System...grabbed some projects, those that seemed ... Interesting... and executed them in an isolated manner.*
RM05					*...However, at the time, they give it to the Water System...The Water System...are like....and then the implementation vision was with (construction) works... Water System ... is that they have a very technical vision...*
RM06	*The potabilisation plants... are another disaster, are ....white elephants. The second plant started to work very recently. The first plant works but as if it is out of phase, without recognising what is the river dynamics, in hydrological terms.*	*It is a very small river, 12 kilometres or ten kilometres of the river inside the natural area and with more than a hundred gabion or geo-costal dams that are interrupting the connection of the main channel with the springs and tributaries. These type of works (gabion dams and ponds).... are financed by temporal employment programmes...These temporary employment programmes are always going to solve.... the reduction of poverty (a national objective). In these terms, they are counterpoising the reduction of poverty and the development of rural, indigenous or ancestral communities with the care of the environment. So you have two very important things, but .... they are in confrontation.*		*There is an illegal water distribution through hoses. The owner of water springs does business, connects hoses and sells his water distributions... This has benefited (informal residents), but there is environmental damage of drying springs ..... that was feeding Magdalena's main channel. This is a problem that they do not want to see or do not want to solve it (Not even the Master Plan). They count the springs but do not realise that all springs have diversions. These diversions have to be solved because all these people have animals, crops and a house, which are maintained with water.* *How do (informal settlers) know how far they have to dig (latrines) to do not to permeate and pollute the aquifers? They ...dug these holes without having any kind of instruction ....it is... empirical what they do.*	

Example from the matrix sample: inductive approach

RM			PUX	
QUOTE	**FRAGMENT**	**CONCEPT**	**FRAGMENT**	**QUOTE**
They were interested, but there was not an answer. The newspaper Reforma brought out the news that the…. Magdalena River, the last living river, was running out….The next day, the mayor said: "no, no, no, no, it is not going to die (the river), we already have the University thinking about the issue and making a proposal" (Interview A).	This project was adopted and supported by the government because of political reasons and to ease the political problems of letting the last river die rather than wanted to save this water element. Hence, this project rapidly became a political matter. The project was also presented to the new mayor of Mexico City and his team. Suddenly it became part of the city's political agenda. Additionally, here it is important to say that this project became a point of political interest, as it was the principal project of the Mayor (RM01 and RM07), which can be an asset as there will be the support from the Metropolitan government. Additionally, here it is important to say that this project became a point of political interest, as it was the principal project of the Mayor (RM01 and RM07), which can be an asset as there will be the support from the Metropolitan government.	RUMOURS	The PUX emerged because of the rumours that emerged about Xochimilco losing the UNESCO Heritage Site declaration (PUX02, PUX05 PUX10, PUX12 AND PUX 14). Thereby, the Municipal Government of Xochimilco responded to such pressure (rumours or criticisms), requesting UNESCO for help and paid for the project (PUX05). Hence, this project becomes political from the beginning, as the Municipality main goal behind this project was to ease the rumours. The development of the Management Plan was the method of minimising such rumours. Hence, the goal was political, and the master plan or conservation of the site was the method to achieve such a goal.	*The management plan in Xochimilco began with a note…. for a rumour that the world heritage site had declared Xochimilco as heritage at risk…. " that we could fall on the risk list"….That alarmed the government. Then it says "well, we are going to have to work very hard" (PUX02).*
RM08 describes that this stage became a "circus of actions", as everybody wanted to do something but without any interest in doing actions related to each other or the river restoration.	Existing NGOs started to demand to be part of the project, showing their particular interest because of the money involved rather than a real concern about the river's restoration (RM08). RM08 describes that this stage became a "circus of actions", as everybody wanted to do something but without any interest in doing actions related to each other or the river restoration.	COMPETITION OF RESOURCES	Here, the intervention of UNESCO seemed to increase the trust of the population to this venture, but some participants mention that UNESCO involvement caused false expectations in the community, such as UNESCO was injecting money and doing everything (PUX02, PUX03, PUX08 and PUX09).	*The belief, the urban legend was that UNESCO had arrived at the site loaded with dollars and that it had given multimillion-dollar financing to the municipality to rescue Xochimilco, and that we (PUX) were the emissaries of those resources (PUX03)*
The Protected Natural Area ... restricts us (the community) a lot... We live from (the area)... It would generate a very strong social conflict because we would not allow it...We know a little bit about the subject, we know what can be done and what we should not do (RM15).	From this Master Plan emerged the idea of implementing a Natural Protected Area with the community support, but this scheme is still vulnerable to politics and power struggles. RM04 describes that the central conflict is about the legal terms of this decree, as the municipality (which paid the project) want to do this protection at the federal level to restrict the influence of SEDEMA (or the metropolitan government). However, this federal classification restricts the community to manage this area (RM11), so the community want to convert it into a local reserve, a Community Ecological Reserve or REC because they can gain economic benefits through this area management (RM04)		According to PUX02, when the PUX was finalising, the main interest was around fighting the Mexico City Centre Trust for funds than to establish the administration system. Hence, there were no mechanisms that guaranteed the PUX continuity nor the *Interinstitutional Commission* transition towards an autonomous body (PUX05).	*The Mexico City Historic Centre Authority...which is a simile (of the AZP) receives about 550, 600 million pesos a year as budget, the Patrimonial Area Authority (Xochimilco) receives 45 or 50, which is like the 10%. However,... look how much area is the Historic Centre of Mexico City? It is small, and how much is territorially the extent and complexity of the heritage polygon of Xochimilco, Tláhuac and Milpa Alta? (PUX05).*
....were more interested in the elections at that time.....and nothing…Now...there is no …(representative of the Magdalena Atlitic Community) (RM04).	Therefore, the university submitted the recommendations for these two alternatives. However, it stopped because of political struggles.	POLITICAL CYCLES	Also, the municipality showed certain disengagement with the project and when the municipal representative change, there was no further support for the PUX. Additionally, the project needed financial support from the governments, but the municipality did not want to pay or continue with this project (PUX05 and PUX06).	

Annexe G

UCL Research Ethics Committee Guidance and approval

UCL RESEARCH ETHICS COMMITTEE
ACADEMIC SERVICES

10 August 2015

Dr Sarah Bell
Department of Civil, Environmental and Geomatic Engineering
UCL

Dear Dr Bell

Notification of Ethical Approval
Project ID: 7327/001: The benefits of doing the 21st century city bluer: advantages of water sensitive urban design in Mexico City

I am pleased to confirm in my capacity as Chair of the UCL Research Ethics Committee (REC) that your study has been approved by the REC for the duration of the project, until August 2018.

Ethical approval is subject to the following conditions:

1. You must seek Chair's approval for proposed amendments to the research for which this approval has been given. Ethical approval is specific to this project and must not be treated as applicable to research of a similar nature. Each research project is reviewed separately and if there are significant changes to the research protocol you should seek confirmation of continued ethical approval by completing the 'Amendment Approval Request Form':

2. It is your responsibility to report to the Committee any unanticipated problems or adverse events involving risks to participants or others. Both non-serious and serious adverse events must be reported.

   Reporting Non-Serious Adverse Events
   For non-serious adverse events you will need to inform Helen Dougal, Ethics Committee Administrator (ethics@ucl.ac.uk), within ten days of an adverse incident occurring and provide a full written report that should include any amendments to the participant information sheet and study protocol. The Chair or Vice-Chair of the Ethics Committee will confirm that the incident is non-serious and report to the Committee at the next meeting. The final view of the Committee will be communicated to you.

   Reporting Serious Adverse Events
   The Ethics Committee should be notified of all serious adverse events via the Ethics Committee Administrator immediately the incident occurs. Where the adverse incident is unexpected and serious, the Chair or Vice-Chair will decide whether the study should be terminated pending the opinion of an independent expert. The adverse event will be considered at the next Committee meeting and a decision will be made on the need to change the information leaflet and/or study protocol.

On completion of the research you must submit a brief report (a maximum of two sides of A4) of your findings/concluding comments to the Committee, which includes in particular issues relating to the ethical implications of the research.

With best wishes for the research.

Yours sincerely

Professor John Foreman
Chair of the UCL Research Ethics Committee

Cc: Fernanda Garciadiego, Applicant

Academic Services, 1-19 Torrington Place (9th Floor),
University College London
Tel: +44 (0)20 3108 8216
Email: ethics@ucl.ac.uk
http://ethics.grad.ucl.ac.uk/

UCL RESEARCH ETHICS COMMITTEE UCL

IMPORTANT: ALL FIELDS MUST BE COMPLETED. THE FORM SHOULD BE COMPLETED IN PLAIN ENGLISH UNDERSTANDABLE TO LAY COMMITTEE MEMBERS.

SEE NOTES IN STATUS BAR FOR ADVICE ON COMPLETING EACH FIELD. YOU SHOULD READ THE ETHICS APPLICATION GUIDELINES AND HAVE THEM AVAILABLE AS YOU COMPLETE THIS FORM.

APPLICATION FORM

SECTION A APPLICATION DETAILS

A1

Project Title: The benefits of doing the Twenty-first Century City Bluer: Advantages of Water Sensitive Urban Design in Mexico City

Date of Submission: 28/07/2015	Proposed Start Date: 20/08/2015
UCL Ethics Project ID Number: 7327/001	Proposed End Date: 02/08/2018

If this is an application for classroom research as distinct from independent study courses, please provide the following additional details:

Course Title: Research Degree: Civil, Environmental and Geomatic Engineering Course Number: RRDCIVSGEO01

A2

Principal Researcher

Please note that a student – undergraduate, postgraduate or research postgraduate cannot be the Principal Researcher for Ethics purposes.

Full Name: Sarah Bell	Position Held: Senior Lecturer
Address: Chadwick 117 University College London Gower Street London WC1E 6BT	Email: Telephone: Fax:

Declaration To be Signed by the Principal Researcher

- I have met with and advised the student on the ethical aspects of this project design *(applicable only if the Principal Researcher is not also the Applicant).*
- I understand that it is a UCL requirement for both students & staff researchers to undergo Disclosure and Barring Service (DBS) Checks when working in controlled or regulated activity with children, young people or vulnerable adults. The required DBS Check Disclosure Number(s) is:
- I have obtained approval from the UCL Data Protection Officer stating that the research project is compliant with the Data Protection Act 1998. My Data Protection Registration Number is: No Z6364106/2015/07/26
- I am satisfied that the research complies with current professional, departmental and university guidelines including UCL's Risk Assessment Procedures and insurance arrangements.
- I undertake to complete and submit the 'Continuing Review Approval Form' on an annual basis to the UCL Research Ethics Committee.
- I will ensure that changes in approved research protocols are reported promptly and are not initiated without approval by the UCL Research Ethics Committee, except when necessary to eliminate apparent immediate hazards to the participant.
- I will ensure that all adverse or unforeseen problems arising from the research project are reported in a timely fashion to the UCL Research Ethics Committee.
- I will undertake to provide notification when the study is complete and if it fails to start or is abandoned.

SIGNATURE: **DATE:** 21/7/15

A3 **Applicant(s) Details** *(if Applicant is not the Principal Researcher e.g. student details):*

Full Name: Fernanda Garcia Alba Garciadiego	
Position Held: MPhil/PhD Student	
Address: Chadwick 221 University College London Gower Street London WC1E 6BT	Email: Telephone: Fax:
Full Name:	
Position Held:	
Address:	Email: Telephone: Fax:

A4 **Sponsor/ Other Organisations Involved and Funding**

a) Sponsor: ☐ **UCL** ☒ **Other institution**

If your project is sponsored by an institution other than UCL please provide details:

Consejo Nacional de Ciencia y Tecnología (CONACYT)

b) Other Organisations: If your study involves another organisation, please provide details. *Evidence that the relevant authority has given permission should be attached or confirmation provided that this will be available upon request.*

c) Funding: What are the sources of funding for this study and will the study result in financial payment or payment in kind to the department or College? ~~*If study is funded solely by UCL this should be stated, the section should not be left blank.*~~

A5 **Signature of Head of Department or Chair of the Departmental Ethics Committee**
(This must not be the same signature as the Principal Researcher)

I have discussed this project with the principal researcher who is suitably qualified to carry out this research and I approve it. The project is registered with the UCL Data Protection Officer, a formal signed risk assessment form has been completed, and appropriate insurance arrangements are in place. *Links to details of UCL's policies on data protection, risk assessment, and insurance arrangements can be found at: http://ethics.grad.ucl.ac.uk/procedures.php*

UCL is required by law to ensure that researchers undergo a Disclosure and Barring Service (DBS) Check if their research project puts them in a position of trust with children under 18 or vulnerable adults.

HEAD OF DEPARTMENT TO DELETE BELOW AS APPLICABLE

I am satisfied that checks: **(1) have been satisfactorily completed**
(2) have been initiated
(3) are not required

If checks are **not** required please clarify why below.

Chair's Action Recommended: ☒ **Yes** ☐ **No**

A recommendation for Chair's action can be based only on the criteria of minimal risk as defined in the Terms of Reference of the UCL Research Ethics Committee.

PRINT NAME:

SIGNATURE: **DATE:** 29/07/15

THE BARTLETT SCHOOL OF ENVIRONMENT, ENERGY AND RESOURCES

BSEER Research Ethics – Low Risk Application – Evaluation (v1.8)

Applicant UCL email address:

Student ~~/ Staff (Cross out as applicable)~~

(If Student) **Course: PhD**

(If Student) **Supervisor:**

(If Staff) **Principal Investigator:**

Title of Study: Is urban-water sustainability possible?

Date of Application: 14 December 2018

The form submitted was a UCL REC Amendment Approval Request Form	Unsatisfactory	Satisfactory	N/A
STUDY DETAILS			
Sufficient study details provided to evaluate ethical implications		X	
Study does not seem to include sensitive topics (see High Risk checklist)		X	
Sufficient sampling details provided to evaluate ethical implications		X	
Sample does not seem to include vulnerable individuals (see High Risk checklist) **Issues dealt with in application approved by UCL REC**			
CONSENT			
Information for participants covers necessary issues adequately **NEEDS CORRECTING - para 'What happens..." error in sentence 3.** (Researcher name & says if student, Institution, funder, study title & purpose, how participant selected, what happens to participant, how long it will take, benefits, potential risks/harms, anonymity/confidentiality, voluntariness, right to withdraw, contact details)			
Information for participants is sufficiently concise		X	
Information for participants is written in an appropriate style **Some errors in one para as explained above.** (Study title and content appropriately phrased for participants, level of detail appropriate for participants)			
(Where participants known to researcher) appropriate procedures to ensure participants feel free to not participate & withdraw from the study			X
EVALUATION & MITIGATION OF HARM			
Risk of harm to participants seems to be minimal (see High Risk checklist)		X	
Recognises & addresses potential risks/harms to participants		X	
(Where risks to researcher beyond those experienced in daily life) has appropriate risk assessment been completed?		X	
DATA PROTECTION & PRIVACY			
Correctly identifies whether/not personal data are being collected / used / processed (Definition of personal data is embedded in the low risk form Q42…check whole application to ensure applicant answered this Q correctly)		X	
Correctly identifies whether/not *sensitive* personal data are being collected / used / processed (Definition of sensitive personal data embedded in the low risk form Q43…check whole application to ensure applicant answered this Q correctly)		X	
(If personal data are being collected / used / processed) has registered study with UCL Data Protection Officer		X	
(Where participants are known to researcher) appropriate procedures to protect participants' privacy (EG data collected &/or collection method)			X

Evaluation:

X Study is low risk and may commence ONCE YOUR SUPERVISOR HAS APPROVED A REVISED PARTICIPANT INFORMATION SHEET

☐ Study is low risk and may commence AFTER you obtain a UCL Data Protection number from UCL Legal – you are collecting personal data

☐ Study is low risk and may commence AFTER you meet the following conditions and demonstrate that to the evaluators:

☐ Study requires revised submission to BSEER Research Ethics Team. Data collection/processing cannot start until the research is evaluated as low risk.

☐ Study requires approval from UCL Research Ethics Committee prior to data collection/processing.

Name(s) of BSEER evaluator(s): Michelle Shipworth Date: 23 January 2018

Annexe H

Risk Assessment Form

Department: Civil, Environmental & Geomatic Engineering

Risk Assessment Form

WORK/PROJECT TITLE: Is urban-water sustainability possible? Concepts, implementation and barriers to enhance Green Infrastructure in Mexico City

LOCATION(S): Mexico City, Mexico

DESCRIPTION OF WORK:
The research comprises the study of two case studies of sustainable projects in Mexico City. Hence, interviews with the main stakeholders and site visits to corroborate the state of the constructions works are going to be carried on.

PERSONS INVOLVED: Fernanda Garcia Alba Garciadiego

HAZARD IDENTIFICATION (*state the hazards involved in the work*)
Transport accident (medium)
High crime rate / theft (medium)
Personal injury (low)
Earthquake (low)

RISK ASSESSMENT (*make an assessment of the risks involved in the work and where possible state high, medium or low risk*)
Mexico is facing a high criminality linked to drug cartels, but Mexico City is relative safe. This investigation comprises fieldwork (observations, photography and interviews) in some irregular settlements, which can represent uncertainty and risk.

CONTROL MEASURES (*state the control measures that are in place for the protection of staff*)
Transport accident: Valid driving licence will be carried all the time. The vehicle is registered, safe and with insurance. All the driving will be in roads, during the daytime and inside Mexico City.
A mobile phone will be carried all time to report any emergency.
High crime rate / personal injury: Any visit to an irregular area is going to be coordinated and approved by the population of the area. As well, the work will be done during the day and always with somebody else company. Use of cell phone with emergency numbers and previous notice to a close relative about daily activities' times and locations. No unnecessary valuable items will be carried.
Earthquake: Familiar with the local emergency protocols
The work is carried in the researcher's hometown so there is awareness of local context and, in case of emergency, she will contact her Supervisor.

SUPERVISOR DECLARATION
I, the undersigned, have assessed the work, titled above, and declare that ~~there is no significant risk~~/the risks will be controlled by the methods stated on this form (*delete as applicable*) and that the work will be carried out in accordance with Departmental codes of practice.

Name: Sarah Bell

Signed: Date: 25/8/16

STUDENT DECLARATION
I, the undersigned, have assessed the work, titled above, and agree to work carefully and thoughtfully, to take the measures designed to protect my safety and that of others as described on this form, and to advise my supervisor of any additional risks or safety concerns that come to my attention.

Name: Fernanda Garcia Alba Garciadiego

Signed: Date: 25/8/16

FIELD / LOCATION WORK

The Approved Code of Practice - Management of Fieldwork should be referred to when completing this form
http://www.ucl.ac.uk/estates/safetynet/guidance/fieldwork/acop.pdf

DEPARTMENT/SECTION CIVIL, ENVIRONMENTAL & GEOMATIC ENGINEERING
LOCATION(S) MEXICO CITY, MEXICO
PERSONS COVERED BY THE RISK ASSESSMENT Fernanda Garcia Alba Garciadiego

BRIEF DESCRIPTION OF FIELDWORK The research comprises the study of two case studies of sustainable projects in Mexico City. Hence, interviews with the main stakeholders and site visits to corroborate the state of the constructions works are going to be carried on.

Consider, in turn, each hazard (white on black). If **NO** hazard exists select **NO** and move to next hazard section.
If a hazard does exist select **YES** and assess the risks that could arise from that hazard in the risk assessment box.
Where risks are identified that are not adequately controlled they must be brought to the attention of your Departmental Management who should put temporary control measures in place or stop the work. Detail such risks in the final section.

ENVIRONMENT	**The environment always represents a safety hazard. Use space below to identify and assess any risks associated with this hazard**
e.g. location, climate, terrain, neighbourhood, in outside organizations, pollution, animals.	Examples of risk: adverse weather, illness, hypothermia, assault, getting lost. Is the risk high / medium / low ? Neighbourhood (medium risk) Natural Hazards (low risk)

CONTROL MEASURES **Indicate which procedures are in place to control the identified risk**

- ☐ work abroad incorporates Foreign Office advice
- ☐ participants have been trained and given all necessary information
- ☐ only accredited centres are used for rural field work
- ☐ participants will wear appropriate clothing and footwear for the specified environment
- ☐ trained leaders accompany the trip
- ☐ refuge is available
- ☐ work in outside organisations is subject to their having satisfactory H&S procedures in place
- ☒ OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

The research takes places in my hometown. Therefore, I am familiar with the context of the studied areas. However, risk in the area can increase due that the research take place in some irregular settlements. To diminish this inconvenient, I will contact memebers of the community and NGO that can introduce me into these areas.
In addition, all site visits will be done during the daytime and with company. No unnecessary valuables are going to be carried and I will notify the duration and location of daily activities to a close relative.

EMERGENCIES	**Where emergencies may arise use space below to identify and assess any risks**
e.g. fire, accidents	Examples of risk: loss of property, loss of life

Risk of emergency (medium) because of the studied area. The student will be constantly in contact with the suppervisor, providing time sheets of activities and contact details for emergency.

CONTROL MEASURES **Indicate which procedures are in place to control the identified risk**

- ☐ participants have registered with LOCATE at http://www.fco.gov.uk/en/travel-and-living-abroad/
- ☐ fire fighting equipment is carried on the trip and participants know how to use it
- ☒ contact numbers for emergency services are known to all participants
- ☒ participants have means of contacting emergency services
- ☐ participants have been trained and given all necessary information
- ☐ a plan for rescue has been formulated, all parties understand the procedure
- ☐ the plan for rescue /emergency has a reciprocal element

This work is being undertaken in my hometown, so there is awarness of the local context. A cell phone is going to be carried all the time and emergency contact numbers

EQUIPMENT	Is equipment used?	No	If 'No' move to next hazard If 'Yes' use space below to identify and assess any risks
e.g. clothing, outboard motors.	Examples of risk: inappropriate, failure, insufficient training to use or repair, injury. Is the risk high / medium / low ?		

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk
☐	the departmental written Arrangement for equipment is followed
☐	participants have been provided with any necessary equipment appropriate for the work
☐	all equipment has been inspected, before issue, by a competent person
☐	all users have been advised of correct use
☐	special equipment is only issued to persons trained in its use by a competent person
☐	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

LONE WORKING	Is lone working a possibility?	Yes	If 'No' move to next hazard If 'Yes' use space below to identify and assess any risks
e.g. alone or in isolation lone interviews.	Examples of risk: difficult to summon help. Is the risk high / medium / low?		

Lone interviews (medium)

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk
☒	the departmental written Arrangement for lone/out of hours working for field work is followed
☐	lone or isolated working is not allowed
☒	location, route and expected time of return of lone workers is logged daily before work commences
☐	all workers have the means of raising an alarm in the event of an emergency, e.g. phone, flare, whistle
☐	all workers are fully familiar with emergency procedures
☒	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

	work with substances		**If 'Yes' use space below to identify and assess any risks**
e.g. plants, chemical, biohazard, waste	Examples of risk: ill health - poisoning, infection, illness, burns, cuts. Is the risk high / medium / low?		

CONTROL MEASURES **Indicate which procedures are in place to control the identified risk**

- ☐ the departmental written Arrangements for dealing with hazardous substances and waste are followed
- ☐ all participants are given information, training and protective equipment for hazardous substances they may encounter
- ☐ participants who have allergies have advised the leader of this and carry sufficient medication for their needs
- ☐ waste is disposed of in a responsible manner
- ☐ suitable containers are provided for hazardous waste
- ☐ OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

OTHER HAZARDS	**Have you identified any other hazards?**	**Yes**	**If 'No' move to next section** **If 'Yes' use space below to identify and assess any risks**
i.e. any other hazards must be noted and assessed here.	Hazard: Zika virus Risk: is the risk **low**		

According to the news Zika virus is in Mexico, still very few cases have been reported.

CONTROL MEASURES **Give details of control measures in place to control the identified risks**

To minimise the risk mosquito repelent is going to be use and emergencies services will be contact in the necessary case.

Have you identified any risks that are not adequately controlled?	**NO** ☒	**Move to Declaration**
	YES ☐	**Use space below to identify the risk and what action was taken**

Is this project subject to the UCL requirements on the ethics of Non-NHS Human Research? No

If yes, please state your Project ID Number

For more information, please refer to: http://ethics.grad.ucl.ac.uk/

DECLARATION The work will be reassessed whenever there is a significant change and at least annually. Those participating in the work have read the assessment.

Select the appropriate statement:

- ☐ I the undersigned have assessed the activity and associated risks and declare that there is no significant residual risk
- ☒ I the undersigned have assessed the activity and associated risks and declare that the risk will be controlled by the method(s) listed above

NAME OF SUPERVISOR Sarah Bell

SIGNATURE OF SUPERVISOR DATE 25/8/16

Annexe I

Master Plan General Structure (González-Reynoso *et al.*, 2010: 100-102).

Strategies	Objectives	Action Lines
1. Ecosystem management and sustainable local development	1.1 Maintain the natural area in good condition	1.1.1 Geomorphological processes reduction, emphasising on the degradation (soil erosion)
		1.1.2 Gravitational processes risk management (flow of debris)
		1.1.3 Diverse ecosystem restoration (by type of ecosystem)
		1.1.4 Forest sustainable management
		1.1.5 Forest fire prevention
		1.1.6 Flora and fauna protection
		1.1.7 Education and communication programmes to promote new relationships with the environment
	1.2 Generate ecological tourism offers and sustainable local development	1.2.1 Environmental services payments evaluation
		1.2.2 Economic activities regulation in the lower part of the natural area
		1.2.3 Control of economic activities in the upper part of the natural area
		1.2.4 Public use conceptual projects in the natural area of the river
2. River and watershed integrated management	2.1 Springs protection and promote aquifer recharge	2.1.1 Aquifer's recharge and discharge protection areas
		2.1.2 Aquifer's recharge
	2.2 Preserve river's cleanliness in the natural area	2.2.1 Riverbed restoration through revegetation in areas near the river
	2.3 Clean up the river that becomes drainage in the urban area	2.3.1 Water flow regeneration through treatment plants
		2.3.2 Water flow regeneration through main drain/sewer pipes
	2.4 Maintain and modernise the river's protection works	2.4.1 Flood prevention and protection
		2.4.2 Maintenance and management of gabion dams
		2.4.3 Anzaldo Dam maintenance and project proposal
	2.5 River's basic flow protection, avoiding unsustainable exploitation	2.5.1 Sustainable use of a certain amount of river's water for drinking
		2.5.2 Rainwater use recommendations
		2.5.3 Technologies proposals for wastewater management
		2.5.4 Techniques description for sustainable water use
3. River's urban-landscape value	3.1 Create a landscaped promenade with public spaces for recreational, cultural and sporting uses	3.1.1 La Cañada conceptual park project
		3.1.2 Sections specifications for the Magdalena Contreras-Coyoacán urban linear park
		3.1.3 Conceptual projects for the restoration and rehabilitation of public spaces with historic, scenic and environmental value
	3.2 Value the river and turn it into an urban space link	3.2.1 Garbage collection and street cleaning services adaptations
		3.2.2 Proposals for river and primary urban structure elements crossing
		3.2.3 Accessibility improving
		3.2.4 Road structure adjustments and reorganisation
		3.2.5 Public transport system modifications and promotion to alternative transportation

4. Territory ordering	4.1 Ordering and regulate government and social actions in the natural area	4.1.1 Zoning and general management policies
		4.1.2 Biophysical environmental units and specific policies
	4.2 Stop illegal urbanisation on Conservation Land	4.2.1 Informal settlements management
		4.2.2 Informal settlements in risk zones
		4.2.3 Urban planning proposals (ordering)
		4.2.4 Expropriations, restatements and acquisitions for public use and promote sustainability
		4.2.5 Programmes to discourage informal natural resources consumption in sub-basins
	4.3 Magdalena River Restoration trigger-projects portfolio	4.3.1 Urban-environmental and landscape Master Plan of the Magdalena River
5. New governance for the project's implementation and monitoring	5.1 Flexible scheme for instruments that allow the project's implementation through interagency coordination and social participation.	5.1.1 Implementation of mechanisms for each strategy
		5.1.2 Cross-boundary instruments of social participation
		5.1.3 Certification system for new projects
	5.2 Master Plan Evaluation	5.2.1 Comprehensive monitoring indicators system
	5.3 Identify issues that need more in-depth knowledge to restore the river.	5.3.1 Research agenda

Annexe J
Project UNESCO-Xochimilco: Executed Programme (UNESCO-Mexico, 2006a, 2006b).

	PHASE 1	PHASE II			PHASE II (EXTENTION)			PHASE III
TIME TABLE	November 2003- February 2004	March 2004-April 2005			June 2005-October 2005			October 2005 -February 2006
ACTIONS	Research and Literature review	Meetings and fieldworks with actors from the community and governmental agencies Studies from agencies (ONU, UNIFEM, FAO, PNUMA). Geo-references, values and effects	Identification of agencies and academics. Social actors' framework.	Training workshops for agencies members in consensus decision making (Information and claims centre for the local community)	Interinstitutional Commission meetings Identification of local action networks	Planning meetings with public agencies in the Interinstitutional Commission Workshops to identify Priority Actions Planning participatory circles (specific topics and groups)	Consensus and coordination of priority actions 2006.	Prospective scenarios for each strategic line (Cultural heritage, appropriation and education, Water management, Production and chinampa agricultural marketing, Tourism as a sustainable activity, Urban planning and accessibility, and Management and financing system) Identify associated tasks to be executed by different levels of government while recognizing attributions and actions carried by the government and social organisations
INSTRUMENTS AND TOOLS	Open and semi-structured interviews. Thematic cards development.	Survey about heritage value and representations. environmental values probe (children) Identification workshops (cultural heritage, programs for children and young population) Cultural Landscapes Forum. chinampa Forum	Interinstitutional meetings. Meetings with academics Current projects with Universities and International Agencies	Logical Framework Workshop-course. SIRCHAL workshop. Academic committees: environment, Culture. Attention to social groups in offices and requested fieldworks	Planning workshops with chinampa landowners Workshop about Gender by UNIFEM.	Participatory workshop. Interviews with government representatives and local leaders.	Workshop on long-term strategic water lines. Workshop about new chinampa, ejidos de San Gregorio	12 institutional meetings 16 social validation round-tables (Gathering locally organized groups and 350 attendees in total)
PRODUCTS	Compact Disc with the informative synthesis; documents, pre-diagnosis and project lines. Project presentation brochure	Report about surveyed values and representations of the Cultural Heritage. Records about meetings and fieldworks. Workshop reports: (chinampa land-owners, tourism, business, education, culture. Geo-positioned maps of values, attributes and threats	Academic Committees formation Social Actors network. Summary table of leaders and social actors interviewed	A forum about women and the environment in Xochimilco. Environmental Fair. Report and logical framework trees. SIRCHAL report and recommendations. Diagnostic Documents Academic Committee Document about agencies and Management Plan design feasibility Bases for the Interinstitutional Commission conformation agreement		World Heritage Fair 2005. Communication material: Introductory, Guiñol theatre and central problems video Interactive CD with describing the process and collaborations of participating actors	Annual Operative Programme, 2006. Investment coordinated between agencies: for the strategic lines	Proposal for the Integral Plan and Management Structure of the Ecological Reserve of Xochimilco, as a Site Inscribed on the UNESCO World Heritage List. Comprised of 226 programs and projects to be developed and executed in 12 years