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The state as a stimulator of wastewater treatment policy: a comparative assessment of three subnational cases in central Mexico

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ABSTRACT

River basin management and decentralisation reforms are promoted worldwide for solving water pollution problems. In Mexico, governmental efforts have been made to operate wastewater treatment plants countrywide, but federal administrations have not achieved their intended outcomes. Acknowledging the role of governance in the implementation of wastewater treatment policy, this paper analyses three cases in central Mexico and addresses the question: How does the governance context affect the implementation of the wastewater treatment policy in central Mexico? A governance assessment tool is applied to answer the question. The assessment allows an understanding of the governance context and is paired with a comparative case study design. Data was collected through semi-structured interviews and documents reviews. The results indicate that the governance context mainly restricts the implementation of the wastewater treatment policy. In all subnational three cases, the river basin management and decentralisation reforms have not reached their objectives. By comparing the three cases, we found that the state level can play a relevant role to decrease fragmentation and to increase the coherence of the wastewater treatment policy. Therefore, strengthening the involvement of the state government and the improvement of mechanisms that limit political machinations can increase the supportiveness of the governance context.

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Introduction

Wastewater treatment is failing around the world (UN WATER, 2014). Water pollution is among the most challenging global problems due to its environmental and health implications. More than half of world's hospital beds are being used by people whose sickness is related to polluted water (Corcoran et al., 2010). It is estimated that 80% of the wastewater is returned to the environment without a proper treatment (Connor, Uhlenbrook, Koncagül, & Cordeiro Ortiagara, 2017). However, if wastewater is properly treated, it can bring important economic, environment and health benefits (Corcoran et al., 2010; WWAP & UNESCO, 2015).

Wastewater regulation and implementation are context dependent (Allaoui, Schmitz, Campbell, de la Porte, & Programme, 2015). Therefore, it is necessary to find context specific solutions instead of panaceas that promise universal remedies (Ingram, 2008). Two of the highly promoted panaceas are decentralisation and

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river basin management, both of which are elements of Integrated Water Resources Management (IWRM) (Gupta, Pahl-Wostl, & Zondervan, 2013). Mexico has adopted both river basin management and decentralisation. According to the National Water Commission (CONAGUA) 'Mexico is fully committed to managing water in an integrated manner, so as to optimize the demand from different sources for the same water resources' (CONAGUA, 2012, p. 5). CONAGUA is the administrative, normative, technical and consultative institution in charge of water management in Mexico. It is a decentralised agency of the Ministry of the Environment and Natural Resources, working through 20 local offices and 13 basin bodies, which are located in the different federal entities (CONAGUA, 2015b).

The attempts to implement river basin management and decentralisation of water management characterise the national water context in Mexico. However, as previous research shows, despite the efforts towards decentralisation (Tortajada, 2004), this policy has failed (Casiano Flores, Özerol, & Bressers, 2017; Wilder, 2010; Wilder & Romero, 2006), and has not brought the expected results (Herrera & Post, 2014). Decision-making power is still centralised and within the hands of CONAGUA (Casiano Flores, Vikolainen, & Bressers, 2016; OECD, 2013; Tortajada, 2004). CONAGUA steers the water policy and it is responsible for formulating the National Water Plan according to the National Water Law (CONAGUA, 2014b). Consequently, river basin organisations are seen as a mere decentralisation of offices instead of a decentralisation of the policy (Jardines Moreno, 2008). Throughout the reforms for river basin management and decentralisation, the implementation of the wastewater treatment policy still faces important challenges. The objectives set by the last two federal administrations have not been achieved (Casiano & Bressers, 2015) neither has the collaboration among the governmental levels, non-governmental organisations and industry. These challenges were analysed 20 years ago (Tortajada, 1998) and unfortunately, they are still present.

Despite this situation, Mexico has been successful in reaching the millennium development goals related to water (SRE, 2015) by implementing different water programmes. Water service delivery and sewage infrastructure have reached over 90% of the population (CONAGUA, 2015b). However, wastewater treatment is still among the remaining challenges. In the last decade, the Mexican government has made important investments in wastewater treatment plant construction and rehabilitation, with poor results though (Casiano & Boer de, 2015; Casiano & Bressers, 2015). Wastewater treatment is still around 50% and many treatment plants present serious deficiencies.

None of the previous National Water Plans (NWP) have reached their objectives regarding wastewater treatment. The NWP is the document that establishes the objectives, strategies and lines of action of the federal government during its time in office (CONAGUA, 2014a). The 2001–2006 NWP had the goal of achieving 65% treatment of wastewater; however, it reached only 36.1%. The 2007–2012 NWP set a goal of 60% and achieved 47.5% (Casiano & Bressers, 2015). In 2014, there were 2337 wastewater treatment plants for municipal wastewater and there were 2639 plants related with the industry sector (CONAGUA, 2015b). However, only very few of these wastewater treatment plants are operating properly. The current 2014–2018 NWP has a goal of 63% treated water (CONAGUA, 2014a) and in 2015 they reported that 55% had been achieved (CONAGUA, 2015a). In the case of industrial wastewater, the treatment rates are only 19.3% and as a result the government has been accused of lacking in their enforcement for the wastewater treatment law (Greenpeace, 2014).

The situation provokes high pollution levels in surface water bodies, generating important health, social, industrial and environmental issues. In Mexico there are still 9.1 deaths per 100,000 inhabitants caused by diarrheic diseases (CONAGUA, 2015b). 'The quality of rivers, lakes and aquifers is at stake. Safe water and adequate sanitation need to be provided to an additional 40 million inhabitants by 2030' (OECD, 2013, p. 3).

Despite the relevance of wastewater treatment in Mexico, a lack of scientific evidence on this topic prevails. Water policy analyses made so far usually focus on supply, demand and distribution, with a much lower interest in sanitation and wastewater treatment (Pacheco-Vega, 2015b). Among the most relevant are the studies on the Lerma-Chapala Basin (Pacheco-Vega, 2009) and Aguascalientes (Pacheco-Vega, 2015a). As Pacheco-Vega concludes, a sub-national analysis is necessary with an in-depth examination of the institutional architecture of wastewater policy (Pacheco-Vega, 2015b) in order to improve our understanding of the governance arrangements. It is also necessary to understand the contextual factors and causal mechanisms regarding the implementation of the sanitation policy (Pacheco-Vega, 2015b).

In order to provide insights to these concerns, this paper acknowledges that collaboration is an important aspect of water management and that context influences how collaboration processes takes place (de Boer, Vinke-de Kruijf, Özerol, & Bressers, 2016). Therefore, we address the following question: *How does the governance context affect the implementation of the wastewater treatment policy in central Mexico?* The implementation process regarding the wastewater treatment policy is examined under four stages, namely planning, construction (including rehabilitation), operation, and monitoring.

Due to the comparative nature of this research, this paper also contributes to the debates on comparative water governance, since few comparative studies have been undertaken in the Mexican context focusing on the governance of wastewater treatment (Özerol et al., 2018). Through bridging this gap, the paper allows us to 1) Contribute to systematic comparative studies in Mexico by comparing three subnational cases with different institutional arrangements and 2) Analyse the wastewater treatment policy from a governance perspective. In this paper, we understand 'water governance' as a 'water governance regime'. This implies that the perspective from which we observe water governance focuses on institutions and social structures, as it will be explained in the following section.

Theoretical background

Collaborative approaches such as IWRM largely depend on process design and institutional configuration (Ananda & Proctor, 2013). Therefore, contextual factors must be considered when reformers push towards an IWRM approach. In this regard, river basin management highlights the importance of collaborative management across institutions in managing complex natural resources. However, the IWRM concept must be seen as a means instead of an end; and reforms have to look for more pragmatic alternatives (Giordano & Shah, 2014).

In order to propose pragmatic answers, water governance assessments have recently called the attention of academia and international organisations. Two recent compilations include respectively 13 and 25 water governance assessment tools (Jacobson, Meyer, Oia, Reddy, & Tropp, 2013; OECD, 2015). Governance assessments have become important because they can help both, identify implementation challenges and support recommendations. They also uncover the relationships between programmes, regulations and the achievement of the established goals (Jacobson et al., 2013).

Many researchers have stressed the importance of the context when assessing water governance, and different frameworks have been developed (Ansell & Gash, 2007; Bressers & Kuks, 2013; Pahl-Wostl, 2009, 2015; Pahl-Wostl, Holtz, Kastens, & Knieper, 2010; Thiel & Egerton, 2011; Van Rijswijk, Edelenbos, Hellegers, Kok, & Kuks, 2014). The framework we use to assess the governance context of each case is the Governance Assessment Tool (GAT) (Bressers et al., 2015). GAT is applicable for multi-level settings with interdependency among actors. These settings allow the GAT to analyse and compare a high number of cases worldwide. Until now the GAT has been used mainly to analyse single cases such as: Palestine (Al-Khatib, Shogier, Özerol, & Majaj, 2017; Judeh, Haddad, & Özerol, 2017) Mexico (Casiano & Boer de, 2015; Casiano Flores et al., 2017, 2016) and England (Vikolainen, Flikweert, Bressers, & Lulofs, 2017). The only comparative analyses until now, correspond to North-west Europe (Bressers, Bressers, & Larrue, 2016) and to an analysis on collaboration in five cases (de Boer et al., 2016). However, none of these comparative analyses present a common operationalisation scale for both the comparison and the systematisation of the GAT.

The GAT is based on the Contextual Interaction Theory (CIT) (de Boer & Bressers, 2011; Bressers, 2009; Bressers & Kuks, 2013; Bressers, Bressers, Kuks, & Larrue, 2016). The CIT is a third-generation implementation theory that attempts to combine or to get the best of the 'top-down' and 'bottom-up' approaches. Third generation scholars have concentrated efforts to understand better the policy implementation process (Lester & Goggin, 1998).

The governance concept as used by the GAT has its roots in public policy and administration literature and it is an attempt to organise the multiplicity of aspects mentioned in those literatures into a concise framework (Bressers & Kuks, 2013). Governance is defined as 'the combination of the relevant multiplicity of responsibilities and resources, instrumental strategies, goals, actor-networks and scales that forms a context that, to some degree, restricts and, to some degree, enables actions and interactions' (Bressers et al., 2013, p. 6). Water

governance refers to the idea that water is managed through the interactions between public and private actors, who operate at various levels, have different perceptions and objectives, and employ various strategies and instruments (Vinke-de Kruijf & Özerol, 2013, p. 2). Thus, governance is seen as ‘beyond merely government’ and as a ‘context’, within which the various actors of water management interact, and are influenced but not determined by it (Bressers & Kuks, 2013).

The GAT comprises two elements, namely dimensions and criteria. The descriptive-analytical elements are elaborated in five dimensions (multi-level, multi-actor, multi-faceted, multi-instrument and multi-resource based), and the assessment is made for each dimension through applying four semi-normative¹ criteria (coherence, extent, flexibility, and intensity). Answering the questions on each dimension provides a systematic description of the governance context. This systematisation is a way of sorting through complexity that allows a reasonable framework for practitioners to consider the context and dynamics of their particular settings (O’Toole, 2004). The five dimensions can systematically describe a specific area concerning a specific issue, such as wastewater treatment (Bressers et al., 2013). This governance regime concept emphasises that governance is seen as the context for action instead of the action itself (Bressers et al., 2013).

The four criteria of the GAT are defined by the questions they pose (Bressers, Bressers, Kuks, et al., 2016):

- Extent: are all elements in the five dimensions, which are relevant for the sector or project being addressed, taken into account?
- Coherence: are the elements in the dimensions of governance reinforcing, rather than contradicting, each other?
- Flexibility: are multiple roads to the goals, depending on opportunities and threats as they arise, permitted and supported?
- Intensity: how strongly do the elements in the dimensions of governance urge changes in the status quo or in current developments?

The five dimensions and the four qualities provide a comprehensive understanding of how the different elements of governance interact and influence the implementation setting. The assessment also provides explanations about the degree to which the water governance regime can be supportive for the actors of policy implementation (Bressers & Kuks, 2013). In other words, the assessment allows deeper understanding of the governance context and how it impacts policy implementation. The GAT is made up of a ‘matrix’ consisting of these five dimensions and four qualities (Bressers et al., 2015). Table 1 shows this matrix and the Methodology section will explain its operationalisation.

Methodology

The existence of a river basin commission and the decentralisation of the water policy are elements present in the selected cases. According to Article 115 of the Mexican Constitution, water services are the responsibility of the municipalities and current management is derived from the National Water Law. The latest Water Law was created in 1992 and underwent an important reform in 2004. This law is considered a major turning point towards IWRM. It established a process of decentralisation of some key functions to municipalities, river basin organisations and irrigation districts. It was supported through important investments to improve wastewater treatment plants (OECD, 2013). Under this law, the Basin Commissions were created to address particular water issues at the sub-basin level. These bodies work as mechanisms for stakeholder participation. CONAGUA has 26 river basin councils that work with 35 river basin commissions, 47 river basin committees, 87 COTAS (Technical groundwater committees) and 39 local clean beach committees (CONAGUA, 2015b).

The process of decentralisation in Mexico started in the 1980s with the delegation of water services to the municipal level (Rodríguez Briceño, 2008). In 1983, reforms established water services as an exclusive function of the municipalities and the state government as transitional entities. In most of the cases the state government transferred the new obligation to the municipalities immediately (Jardines Moreno, 2008). However, the Mexican Constitution also states that municipalities can collaborate with other municipalities or the state

Table 1. Water governance assessment matrix.

Governance Dimension	Qualities of the governance regime			
	Extent	Coherence	Flexibility	Intensity
Levels & Scales	How many levels are involved and dealing with an issue? Are there any important gaps or missing levels?	Do these levels work together and do they trust each other between levels? To what degree is the mutual dependence recognised?	Is it possible to move up and down levels (upscaling and downscaling) given the issue at stake?	Is there a strong impact from a certain level towards behavioural change or management reform?
Actors & Networks	Are all relevant stakeholders involved? Who are excluded?	What is the strength of interactions between stakeholders? In what way are these interactions institutionalised in stable structures? Do the stakeholders have experience in working together? Do they trust and respect each other?	Is it possible that new actors are included or even that lead shifts from one actor to another when there are pragmatic reasons for this? Do the actors share in social capital allowing them to support each other's task?	Is there a strong impact from an actor or actor coalition towards behavioural change or management reform?
Problem Perspectives & Goal Ambitions	To what extent are the various problem perspectives taken into account?	To what extent do the various goals support each other, or are they in competition or conflict?	Are there opportunities to re-assess goals?	How different are the goal ambitions from the status quo?
Strategies & Instruments	What types of instruments are included in the policy strategy and are implemented and which are excluded?	To what extent is the resulting incentive system based on synergy? Are there any overlaps or conflicts of incentives created by the included policy instruments?	Are there opportunities to combine or make use of different types of instrument? Is there a choice?	What is the implied behavioural deviation from current practice and how strongly do the instruments require and enforce this?
Responsibilities & Resources	Are responsibilities clearly assigned and sufficiently facilitated with resources?	To what extent do the assigned responsibilities create competence struggles or cooperation within or across institutions?	To what extent is it possible to pool the assigned responsibilities and resources as long as accountability and transparency are not compromised?	Is the amount of allocated resources sufficient to implement the measures needed for the intended change?

government to provide the water services (IMCO, 2014). The policy of delegating water services to utilities at the municipal level has been criticised during the last years. The municipality, even when it is the closest to the public, has a short-term government of three years (Rodríguez Briceño, 2008) and lacks both financial and technical resources for water policy implementation (IMCO, 2014; Pacheco-Vega, 2015a; Pineda, 2002; Pineda & Salazar, 2008).

The three selected cases are located in central Mexico and they belong to the Valle de Mexico and Balsas basins. The case of Lago de Guadalupe-Estado de Mexico is located in the Valle de Mexico basin and the cases of Atoyac-Puebla and Zahuapan-Tlaxcala belong to the Balsas basin. The two basins have the biggest challenges in water quality and wastewater treatment infrastructure (CONAGUA, 2011).

The Atoyac River belongs to the Balsas basin, it is the third most polluted river in Mexico and crosses the states of Puebla and Tlaxcala (Lira, 2016). The pollution of this river affects 2,300,000 inhabitants in the state of Puebla (Ochoa & Arroyo, 2016). The basin is formed by the Atoyac and Zahuapan rivers and has the highest mortality index for less than 5-year-old children. The mortality is caused by gastrointestinal diseases due to the river pollution (Gómez, 2016). In the case of the Presa Guadalupe, the pollution has mainly created an environmental problem. Massive death of birds and fish in the main lake of the basin have been reported at different occasions (Chávez, 2005; Chávez & Martínez, 2008; Cruz, 2017). Although the state government granted the status of natural protected area in 2004, the lake is highly polluted and the water is not suitable for human consumption or recreation and it is considered one of the most polluted lakes in the country (Ríos, 2017).

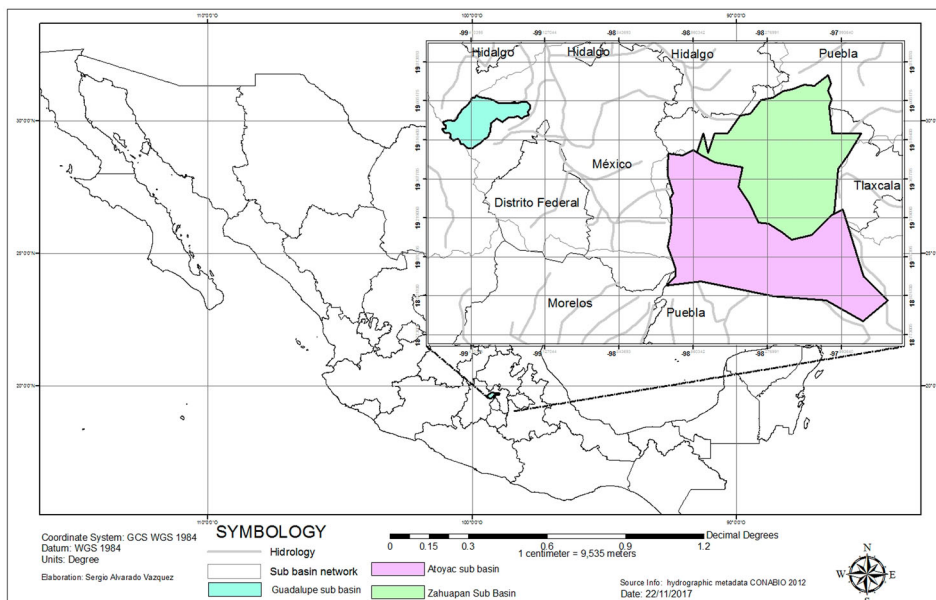


Figure 1. Location of the cases.

The three cases are also part of the most populated metropolitan area, the central Mexico megalopolis. [Figure 1](#) shows the location of the cases.

The three cases were selected because they present differences in their institutional arrangements to address the wastewater treatment policy, while sharing a common goal with different outcomes. In the case of Puebla, the different governmental levels participate through the implementation of the CONAGUA programmes. While the federal and state governments build the wastewater treatment plants (WWTPs), the municipalities are entitled to operate them. In the case of Tlaxcala, the implementation is also through CONAGUA's programmes, however, the state government has started a regionalisation policy of the WWTPs. They operate some plants directly and charge the municipalities for this service. For this purpose, reforms took place at the state level. In the Presa Guadalupe case, the policy is also implemented through CONAGUA's programmes and a River Basin Commission with social participation was created to support the implementation process. [Figure 2](#), shows the institutional configuration of the cases.

A case study approach was adopted, since it is relevant for studies, in which context can make a difference (Kaarbo & Beasley, 1999, p. 388). It also follows a comparative design that analyses and synthesises the similarities, differences and patterns across multiple cases that share a common focus or goal (Goodrick, 2014). We consider that the diversity of the institutional arrangement represents the most common institutional scenarios nationwide. However, we are aware that the geographical region can pose certain limitations regarding the conclusions of our study (Geddes, 1990). The way the cases are compared is by showing the similarities and differences across them. Regional variations are analysed under the common national context of central Mexico. Table A in the supplementary material presents the operationalisation of the elements of the GAT to assess the three cases. Until now, this table has only been applied for Presa Guadalupe case (Casiano Flores et al., 2017, p. 33). This is the first time that is being applied for the other two cases for comparative purposes. This supplementary table helps us to present in a transparent manner the elements considered to assess each case.

To assess each cell, each response is analysed individually, then compared and/or complemented with the rest of the stakeholders' answers and data from secondary sources. The degree of the quality in each dimension is compared with the rest to find a general assessment per quality. The quality per cell can be ranked as high, moderate or low. The matrix was used to assess the three single cases and to allow comparison among them. The final result can be: High support, Moderate support, Moderate-low support and Low support.

Cases			
	Alto Atoyac Puebla	Alto Atoyac Tlaxcala	Presa Guadalupe
Commission status	No Commission at the sub-basin level	Commission created at the sub- basin level. However, it was not implemented	Commission created at the sub- basin level and it has been implemented
Federal government	Federal level: CONAGUA Basin Organisation & Delegation in Puebla	Federal level: CONAGUA Basin Organisation & Delegation in Tlaxcala	Federal level: CONAGUA Basin Organisation & Delegation in Estado de Mexico
State government	State government of Puebla	State government of Tlaxcala, implementing a regionalisation policy	State government of Estado de Mexico
Municipal government	Water utilities at the municipal level	Water utilities at the municipal level	Water utilities at the municipal level

Figure 2. Institutional configuration of the three selected cases at the sub-basin level.

When the general assessment is from moderate to high, the quality is considered supportive, otherwise is restrictive. High means that most of the categories of the quality were from moderate to high. Moderate is when most of the categories are from moderate-low to high. Moderate-low is when most of the categories are assessed from moderate-low to low and it is low when there is an overwhelming majority of low degree in each category of the quality.

The qualities are assessed mainly based on the interviewees' answers. A total of 66 semi-structured interviews were conducted between July 2013 and March 2016. The case of Puebla involved 23 interviews (2013–2015). In the case of Tlaxcala, 21 interviews took place (2014–2015), and Presa Guadalupe involved 20 interviews and two questionnaires via email (2015–2016). Table 2 shows the affiliations of the interviewees. This primary research is supported with official documents and reports from governmental institutions as well as international organisations. Electronic newspapers were also reviewed.

Description of the cases

Tlaxcala

The Atoyac-Zahuapan sub-basin hosts 79.5% of the Tlaxcala state inhabitants (Rodríguez, 2010). The interest for wastewater treatment in Tlaxcala started in 1985. Then the state government created The Company for

Table 2. Affiliations of the interviewees.

	Puebla	Tlaxcala	Presa Guadalupe
Federal	CONAGUA Balsas Organisation, CONAGUA Delegation, PROFEPA (Environmental Attorney)	CONAGUA Balsas Organisation, CONAGUA Delegation	CONAGUA Delegation, Presa de Guadalupe Commission
State	CEAS (Water State Commission), Ministry of Infrastructure, MIRA (Module of Information about the Atoyac River), Ministry of Finance	Coordinacion General de Ecologia (General Coordination of Ecology), SECODUVIT (Ministry of Infrastructure), CSITARET (Centre for Integral Water Treatment), CEAT (State Water Commission)	CAEM (Water State Commission), Ministry of the Environment, Ministry of Agriculture
Water utility	SOAPAP (Water System Operator for Drinking Water and Sewage of Puebla) SOSAPACH (Water System Operator Cholula), SOSAPAHUE (Water System Operator Huejotzingo), SOSAPATEX (Water System Operator Texmelucan)	CAEM Tlaxcala (Water Utility of Tlaxcala), CAEM Chiautempan, CAEM Huamantla, CAEM Apizaco, CAEM Tlaxco	SAPASA (Water Utility of Atipazan), OPERAGUA (Water Utility of Cuautitlan Izcalli), Isidro Fabela Representative in the Presa de Guadalupe Commission
Industry	CCE (Business Council Coordinator)	Textile Industry	Aquaculture
Civil society	Los Atoyaceros, Water activists	Colegio de Tlaxcala, Fray Julian Garcés NGO, PRONATURA NGO	Comité de Rescate del Lago de Guadalupe, Water activists

Control of Polluted Water in the State of Tlaxcala and The State Drinking Water and Sewage Commission (Rodríguez, 2010). In 2009, the new State Water Law established two governmental bodies, the Water State Commission (CEAT), which is considered the organisation for water related matters with technical, normative and consultation capacity and the Centre for Integral Water Treatment (CSITARET). The CSITARET is in charge of the wastewater treatment policy. It operates some WWTPs and monitors the quality of water discharges. In 2011, only 2 out of 128 WWTPs were operating but in May 2014, the state government announced that 61 WWTPs were working, representing 61.08% of the treatment capacity (Casiano Flores et al., 2016, p. 6). Legislative reforms were made to improve the government's capacity in wastewater policy implementation. Since 2011, a wastewater treatment regionalisation process is ongoing, and currently the state government operates nine WWTPs and monitors 60 (Casiano Flores et al., 2016).

Puebla

Puebla's Alto Atoyac sub-basin is part of the Balsas River Basin. In 2010, Puebla's Alto Atoyac sub-basin had 22 WWTP located in 7 municipalities (CEAS & SSAOT, 2012). The wastewater treatment policy started in 1997 when the first River Declaration was created. This legal document established the parameters that must be considered for wastewater discharges permits. It was expected that the river could protect aquatic life in 2015. However, the Atoyac river went from being the seventh to the third most polluted river in Mexico (Castillo, 2013). The three levels of the government and the society do not perceive any improvement in the water quality and wastewater treatment capacity was reported as 10%, instead of the 35% stated by the previous federal administration (Casiano & Bressers, 2015). The last relevant action from the state government was in 2014 when the main water utility was privatised. Currently, the four WWTPs are not working properly (Méndez, 2016). The suspended solids are 240% higher than the River Declaration parameters while Biochemical Oxygen Demand (BOD) is over 1010% (Dale la cara al Atoyac, 2016) and only from 1% to 2% of the industry sector and municipalities meet the discharge quality norm (Camacho Fierro, 2016).

Presa Guadalupe

The Presa Guadalupe sub-basin is formed by five municipalities in the Estado de Mexico. In 2006 after a massive fish death in 2004, the Presa Guadalupe River Basin Commission was created in a bottom-up process to improve water quality in the sub-basin (Franco-Garcia, Hendrawati-Tan, Gutierrez-Diaz, Casiano, & Bressers, 2013). An

important collaborative effort took place in 2006, when the Commission members with CONAGUA and the Mexican Institute of Water Technology (IMTA) created a strategic plan. This plan contained specific goals to address the basin problems, including water pollution (Franco-Garcia et al., 2013). Ten years after the creation of the plan and the basin Commission, stakeholders agree that pollution problems still remain (Casiano Flores et al., 2017). Until 2013, the municipalities that form the sub-basin had 18 WWTPs (CONAGUA & SEMARNAT, 2013). The interviewees mentioned that the WWTPs do not operate properly, if not at all.

Results of the assessments and their comparative analysis

Table 3 presents the result of the three assessments. These results are somewhat different from the previous studies of Puebla (Casiano & Boer de, 2015) and Tlaxcala (Casiano Flores et al., 2016). The reasons are that they were the first analysed cases and therefore the contextual knowledge was more limited. For example, the case of Puebla did not include the monitoring stage of the wastewater treatment policy. While in the case of Tlaxcala, the policy of regionalisation was also a new element that was not analysed previously. Comparing the three different cases allows a standardisation and refinement of the assessment; and permits a larger temporal scope of analysis. A detailed explanation of the individual assessments can be found in the supplementary materials of this article.

Based on the individual assessments presented in Table 3, we first address the restrictive characteristics of the governance context and then the supportive ones. In this way, the restrictive and supportive effects of the governance regime on the implementation process are shown in a systematic manner.

The restrictive characteristics of the governance context

Extent is ranked as moderate-low in both Tlaxcala and Estado de Mexico and low in Puebla. In the multi-level scheme, the three cases share two characteristics. The federal government is the main driver of the policy, supported by the state government, and the municipal level is the least involved level, who has insufficient resources and capacity to enforce the policy. Societal actors are excluded from the policy implementation and this is reflected in the perspectives considered. Some governmental actors emphasise that societal participation brings complexity and problems to the implementation. In all cases, NGOs are setting the topic on the governmental agenda. However, they do not impact the policy in any phase. The way these non-governmental actors call the attention from the government varies across cases. Tlaxcala is the extreme case, where the NGO has made legal allegations against the government.

In the three cases, the institution where the state and federal government take decisions about policy implementation is the Commission of Regulation and Follow up (CORESE). The CORESE is created by the Rules of Operation of CONAGUA's programmes. It allows the state government to present proposals to the programmes of the federal government (CONAGUA, 2013). The investments through these programmes require co-investments from the state and the municipal level, and the state level plays an important role in the planning phase and the tender. Thus, the role of the state government has increased as part of this decentralisation process. This situation is present in different degrees in the three cases. A lack of secondary law of the National Water Law weakens its implementation. However, several mandatory norms are in place. In Puebla and Tlaxcala, they share the River Classification, a legal document enacted by the federal government, where the parameters for wastewater discharges were made stricter, and they must be considered when granting new discharge permits.

Responsibilities are clearly assigned in all cases. However, only few are facilitated with resources. The federal government does not perceive any improvement in the outcomes of the water utilities since the decentralisation process started in the 1980s (CONAGUA, 2015c). Planning, operation and monitoring responsibilities lack most of the resources. The main amount of economic resources is placed on the construction or rehabilitation of the plants. In the three cases, the WWTPs present operational problems or they are abandoned.

Coherence was assessed as moderate to low in Tlaxcala and Guadalupe. However, in the three cases the governmental actors acknowledge dependency among the three levels. Lack of trust also exists, particularly in the

Table 3. Individual results from the governance assessments.

Governance Dimension	Alto Atoyac Puebla				Atoyac-Zahuapan Tlaxcala				Presa Guadalupe, Estado de México			
	Qualities				Qualities				Qualities			
	Extent	Coherence	Flexibility	Intensity	Extent	Coherence	Flexibility	Intensity	Extent	Coherence	Flexibility	Intensity
Levels & Scales	Low	Low	Low	Moderate-Low	Moderate	Moderate	Moderate-Low	Moderate	Moderate	Moderate-Low	Low	Moderate-Low
Actors & Networks	Low	Low	Low	Low	Low	Low	Low	Moderate	Moderate-Low	Moderate-Low	Low	Low
Problem Perspectives & Goal Ambitions	Low	Low	Low	Low	Low	Moderate	Low	Low	Low	Moderate-Low	Low	Low
Strategies & Instruments	Moderate-Low	Moderate	Low	Low	Moderate	Moderate	Low	Moderate-Low	Moderate-Low	Moderate-Low	Low	Low
Responsibilities & Resources	Low	Moderate-Low	Low	Low	Moderate-Low	Moderate	Moderate-Low	Moderate-Low	Low	Moderate	Low	Low
Contextual effect:	Low: Restrictive	Moderate-Low: Restrictive	Low: Restrictive	Low: Restrictive	Moderate-Low: Restrictive	Moderate: Supportive	Moderate-Low: Restrictive	Moderate: Supportive	Moderate-Low: Restrictive	Moderate-Low: Restrictive	Low: Restrictive	Low: Restrictive

cases of Presa Guadalupe and Puebla. The interactions of the governmental actors are institutionalised due to the CORESE. The Presa Guadalupe case is the only one that adds another institution. The governance context is not supportive of the river basin commissions. In the Tlaxcala case, the commission never had a session and in the Presa Guadalupe does not impact the policy. The CORESE and the Presa Guadalupe Commission institutions confront important challenges every three and six years, when due to elections, changes in the governmental configuration take place. According to the state and federal actors interviewed, the main challenge comes at the municipal level, where the election period is every three years.

Interviewees agree that the institutional arrangement was set to create cooperation. However, instability due to elections, fragmentation and political factors affect this cooperation setting. One of the main challenges is the budget assignment for projects. There is a lack of coherence between the Ministry of Finance and the CONAGUA for project funding. The CONAGUA has to prove that the projects have legal, environmental, social and economic feasibility. After this approval, the Ministry of Finance selects the projects. CONAGUA and the Ministry of Finance evaluate programmes on different parameters. In case of a problem that requires two infrastructure projects to work together, the possibilities of only one getting the funds are high. As a result, governors sometimes lobby for very specific projects, and the promises from the president are the main priority for the Ministry of Finance.

Flexibility is low in the three cases. This issue can be explained by the hierarchical system and the lack of trust. The influence of the hierarchy begins at the planning stage. Each governmental level has to adjust their planning to the next upper level. Therefore, the hierarchical and legal structure favours that the leadership be expected from the federal government, and the state and municipal levels must adapt their plans to the national goals. This situation limits their scope of actions as they respond to upper levels instead of their necessities. Due to lacking resources and capacity leadership is expected from the upper levels who commonly have more resources. This setting provokes that the river basin planning is not connected with the formal planning structure, making the integrated planning a mere superficial element. The national and state laws allow creating agreements between different governmental levels or among them, enabling a certain degree of flexibility.

New actors are not allowed in the CORESE, and since the policy is implemented through CONAGUA's programmes, the Rules of Operation is the legal element that defines which actors can participate. Until 2015 the participation was limited to the state and the federal government. However, since 2016 the participation includes the municipal level too. Governmental and non-governmental actors work separately. The governmental levels only support each other limiting themselves to what is mandated by law.

Lack of assessment is also a regular occurrence at the three governmental levels. This impacts the policy negatively, since assessments are vital for lesson learning (Matland, 1995). A realistic assessment comes when governmental changes take place and the new authorities aim to show how the last administration failed in their intended goals. However, this is a political strategy. Lack of flexibility also affects planning. For WWTP construction or rehabilitation, the state government has one year to plan and execute any associated actions, thus low-quality planning and poor execution is common. Multi-annual projects require high levels of planning since changes in the prices are not allowed and the Ministry of Finance rejects on average 90% of the proposals. The Ministry of Finance does not easily approve multi-annual planning because that part of the budget cannot be taken into account anymore in case of budget cuts or if there is the necessity to make changes in the budget through the year. Therefore, actors at lower governmental levels prefer to limit themselves to annual planning and multi-annual projects are not commonly submitted. Short office terms and lack of knowledge limits their interest to seek actions outside the managerial establishment.

The resources are pooled together under CONAGUA, who is the biggest spender in the water sector. However important problems were mentioned about accountability, and this element is a condition for increasing regulatory effectiveness (May, 2007). For the construction of WWTPs, the federal government commonly provides around 50% of the cost and the state and municipal level 25% each. The actor in charge of the tender is the state government. In this sense, it is the state level under the authorisation of CONAGUA that decides how the construction budget will be spent. Complaints about mismanagement and over-pricing were mentioned by the federal and municipal level as well as non-governmental actors against the state level behaviour.

Intensity is low in Puebla and Presa Guadalupe. However, the three cases share similarities about the coalition of actors favouring the implementation. The network that is impacting the policy is formed by the state and federal government. Also in all three cases, this network has not been capable of achieving the goals presented in the different plans. For Puebla and Presa Guadalupe, the actors do not perceive improvements in the water quality and they do not notice changes in this regard. Therefore, important modifications are required to improve enforcement. For example, only a few municipalities have discharge permits, and this creates an economic burden for the water utilities since a lack of this permit creates sanctions from CONAGUA. This limits their already scarce resources.

In all three cases, particularly for Puebla and Presa Guadalupe, concerns were raised about the tender process for the construction of the WWTPs. For all the cases, at least one interviewee argued that CONAGUA overlooks municipalities and had uneven enforcement towards the industry sector. However, interviewees from CONAGUA argue that it is very difficult to sanction municipalities since they cannot close down their wastewater discharges, because if they do it would create a social problem. In this regard, law enforcement is a common complaint from NGOs against municipalities and the industrial sector.

The amount of resources for all the implementation phases is limited. In the three cases, municipalities are facing main challenges. On average, the water utilities in Mexico obtain 75% of the economic resources they need to operate (IMCO, 2014). The main funding should come from the municipalities through the water tariffs they charge. There is a norm to evaluate and establish the water tariff (CONAGUA, 2015b). However, the final tariff is established based on the negotiations in the Congress, where politicians are concerned about their political career. CONAGUA and the State Water Commissions also lack personnel. The most dramatic case is Presa Guadalupe, where only one person is in charge of reviewing the WWTP projects for all the Estado de Mexico, which has a population of more than 15 million people (INEGI, 2015). When the CONAGUA was created in 1989, it had 38,188 employees, and in December 2014 the number has been reduced to 13,661 (CONAGUA, 2015b).

Monitoring at the municipal level is also uncommon, and water utilities lack resources to fulfil all their responsibilities related to the policy; they require the support from upper levels. Construction and rehabilitation of plants is another important issue for Puebla and Presa Guadalupe. Majority of the water utilities argue that their plants are in bad condition and they require important investments. There is a low capacity from the federal government to verify the planning and to audit the resources. CONAGUA has a limited capacity to document how states manage their resources as well as irregularities in the use of federal funds (OECD, 2013). It seems that CONAGUA is financing more projects than the ones they can properly monitor. This makes accountability an important issue that needs to be addressed.

The supportive characteristics of the governance context

Extent is not very supportive in all three cases. However, Tlaxcala and Presa Guadalupe deserve special attention as some of the dimensions were assessed as moderate. In the case of Tlaxcala, extent was moderate for the levels and scales dimension. This is due to the regionalisation policy and the programmes between the state and the municipal level. In this particular case, the state government is responsible for the planning, operation, construction and monitoring of the WWTPs. The municipalities pay a fee for the treatment, and this way the state government secures resources for the operation and the municipalities are not concerned about their technical capacity for the operation or the rehabilitation of the plant. The other moderate aspect comes from the active role the state government has had through the reforms that allow them to increase resources and to bring stabilisation to the implementation process. In the Presa Guadalupe case, the involvement of the state level indicates moderate supportiveness for the levels and scales dimension. However, the role of the state has been more limited as compared to Tlaxcala. The state government has not been able to charge the municipalities for the operation of the WWTPs and the regionalisation policy has not been implemented in this sub-basin.

Coherence was assessed as moderate in the case of Tlaxcala. Before 2016, the CORESE involved only the state and the federal government. The limitation to these two actors and therefore the increasing coherence for the implementation policy phases has also increased trust, mainly among the state and federal government.

The longer stability of these two governmental levels has also supported the implementation. The relationship is also favoured by a more balanced power status. Fewer number of actors also means less complexity and this can favour the alignment of perspectives and goals. It seems that in this context, this situation helps the reaching of agreements and actions that can improve the policy implementation. When the municipalities were in charge of the operation their perspective was not considered, and therefore operational problems were present. Civil servants from the Tlaxcala's Water State Commission succeeded in bringing operation concerns to the table at the Ministry of Infrastructure to keep the price of treatment as low as possible. This is different from the usual experience of the water utilities, who argue that they are not heard by the state government. Currently, the role of each actor seems more specific and synergy among the federal and state government is easier to develop. The involvement of only two upper levels allowed in this case a high degree of cooperation among them and this facilitated the implementation.

Flexibility has the most supportive role in the case of Tlaxcala. However, it was still moderate-low. A supportive aspect is present since the government took a step forward by creating agreements with the municipalities to take the responsibility of operating the WWTPs and this has improved the implementation. Resources are being pooled favouring the implementation. For example, some plants receive wastewater from different municipalities so costs are shared among them. There are six inter-municipal plants that provide service to 14 municipalities and three of them to industrial corridors. The resources for the operation of these plants come from the subsidy of the state government, municipal fees, industrial fees and incentives from the federal government. Nevertheless, dependency on the upper level is maintained by the institutional arrangement and CONAGUA's programmes reinforce the *status quo*.

Intensity was also assessed as moderate in the case of Tlaxcala. One of the main reasons is the policy of regionalisation which has been strengthened by the reforms at the state level. In the Tlaxcala case, the interviewees perceive more interest from the state government and they emphasised that the impact on policy implementation comes from the coalition of the state and the federal government. The published state reforms of the State Financial Code (2009) and changes to the Federal Fund for Strengthening the Municipalities (2014) have favoured intensity (Casiano Flores et al., 2016). The changes to the Federal Fund and the State Financial Code provide the state government with economic resources from the municipalities for operating the WWTPs. The state government has made significant investments to increase monitoring of the discharges for the municipalities and the industry sector. Despite these efforts, the goals established by the River Classification are still far from the current situation.

Discussion and conclusion

This paper presented a systematic and comparative governance assessment of the wastewater treatment policy in central Mexico. To do so we addressed the question: *How does the governance context affect the implementation of the wastewater treatment policy in central Mexico?* To compare the three cases, we standardised the application of the GAT for the wastewater treatment policy. With this comparison, we have addressed the lack of sub-national analysis with an in-depth examination of the institutional architecture of wastewater policy and the understanding of the contextual factors that affect the sanitation policy.

Table A of the supplementary material shows the operationalisation of the GAT, which has been tailored to the three most common institutional scenarios for WWTP policy implementation in Mexico. Therefore, it can later also be employed to assess other cases. The results show that the governance context is not supportive of implementing the wastewater treatment policy. The policy implementation still lacks a basin vision and a long-term perspective. The involvement of stakeholders is also limited. None of the Basin Commissions create the expected impact. The Tlaxcala Commission never had a session and the Guadalupe Commission does not impact the policy implementation. The implementation relies on political factors, and economic resources are dependent on the inter-ministerial negotiations between CONAGUA, the Ministry of Finance and political interests.

We found that decentralisation and river basin management policies, combined with the hierarchical system, result in the federal and municipal government providing a similar context in the three cases, despite their

institutional configuration. As it was diagnosed 10 years ago, IWRM still remains an elusive goal (Scott & Banister, 2008). The federal level is still the main driver of the policy, and the least capable actor is the municipal level. In this sense, our comparative assessment revealed that the state level can play a determinant role in implementing the wastewater treatment policy. The current context mainly supports symbolic participation (Casiano Flores et al., 2017) and symbolic implementation of the policy (Casiano & Boer de, 2015).

Accountability of governmental actors needs to be addressed. Tlaxcala is the only state where the website of the Water State Commission presents detailed information about the investments and monitoring of the WWTPs. We found that in the three cases, the NGOs have been pushing the topic into the agenda, promoting awareness and acting as watchdogs. The industry sector demands even implementation and support from the government. They question whether or not the government wants to enforce the law on them while many governmental entities do not meet the discharge parameters.

The lack of stability and capacity at the municipal level creates challenges for the policy implementation, and these conditions should be considered when decentralisation and basin management are to be enforced. The three cases prove that there is lack of interest from governmental actors to collaborate with social groups. The most dramatic case being the Presa Guadalupe Commission, which exemplifies that implementation of participatory mechanisms do not necessarily improve the management and governance of water resources in the long term (Vinke-de Kruijf & Özerol, 2013). This argument regarding the complexity of social participation in young democracies, is strengthened by a recent study in Mexico, which found that when institutions at the local or municipal level are successful with social participation, politicians will try to regain control over such institutions; since they become both a social and a political capital for politicians' careers (Herrera, 2017).

The concerns regarding the lack of monitoring capacity as well as vertical and horizontal coordination are not new; they were pointed out 20 years ago (Tortajada, 1998). The fact that these concerns are still present, show that the reforms did not have the expected results. A more pragmatic alternative, based on our findings might be the promotion of a more active role of the state government. Under the current context in central Mexico, the decentralisation of the policy strengthens the importance and the role of the state government. Concentrating on the collaboration between the state and federal government as well as strengthening the role of state government seems to be an adequate response. There is a positive correlation between the degree of restrictiveness placed on the policy implementation process and the role of the state level. The most restrictive context is, where the participation of the state government is the most limited. Strengthening the role of the state government and the improvement of mechanisms that limit the impact of political machinations can be instrumental to increase the supportiveness of the governance context.

There is ample evidence provided by our comparison of subnational cases that in the context of the rest of water governance conditions in central Mexico, the state level is the single most influential factor. However, it is important to emphasise that the state level involvement is different in each case. Acknowledging the geographical limitation of this research, additional evidence from other regions of the country can strengthen the conclusions derived from the three cases examined in this paper. Recent findings show that among the best performing water utilities for WWTP policy are those that operate at the state level. Such as Nuevo Leon (Aguilar-Barajas, Sisto, & Ramírez Orozco, 2015; Herrera, 2014) and Aguascalientes (Pacheco-Vega, 2015a) both in the north of Mexico. While in Nuevo León, the water utility works at the state level. In the cases of Aguascalientes and Tlaxcala, the operation and construction of wastewater treatment plants is now a responsibility of the state level, although they are not in charge of all the water-related services. The role of the state government seems relevant in the Mexican context. However, its participation and collaboration needs to be tailored to the contextual circumstances.

The state government's participation faces two challenges. In all the three cases, the involvement of this governmental level is not mandatory. According to the law, main responsibilities for policy implementation are at the municipal and national level. Therefore, lack of legal responsibilities decreases the chances of enforcement, making the interest of the state government a prerequisite.

One of the main challenges that the state participation faces is its discretionary capacity. In Puebla, co-investment programmes and their requirements favour political manipulation and the state government support municipalities for political reasons. Under these conditions, multi-level governance supports political

clientelism, and political inference takes part of the implementation process. Consequently, mechanisms that diminish political factors, should be strengthened, as well as increasing monitoring from the federal level to the state government. International organisations suggest efficiency gains in the government through downsizing bureaucracy. However, in the studied cases, it is necessary to increase the number of employees to monitor and enforce policy implementation.

Organisations such as the OECD recommend that the Mexican government increases its efforts towards decentralisation (OECD, 2013). However, until now, the Mexican government has not seen important improvements since the mid-80's (CONAGUA, 2015c). Besides these results, the Mexican government continues with this agenda. In 2015, CONAGUA asked for a credit of \$200 million dollars from the Inter-American Development Bank to partially finance a programme called Integral Development of the Water Utilities (PRODI) (BID & CONAGUA, 2016). The objective of this programme was to improve the operative and financial sustainability of the water utilities, at the municipal level (BID & CONAGUA, 2016).

It is under these circumstances that the systematic comparison of the GAT proves its value and the relevance of a contextual analysis. While one can agree with the diagnosis of the OECD, there are disagreements about the proposals. It seems that the goal is the implementation of IWRM. This research, as well as other previous studies, supports the thesis that the role of the state government in a federal system is no longer a 'weak link' (Lester & Goggin, 1998) or a vehicle to transfer responsibilities. Due to the fragmentation in the water policy, there is a need for better coordination of water resources (Suhardimana, Clementb, & Bharatib, 2015), and complex institutional systems are fragmented due to a lack of overall coordination (Lubell, 2015). There are two ways to decrease this fragmentation. One is through 'interactive forms of governance', meaning the involvement of stakeholders in the decision making process (Edelenbos & Van Meerkerk, 2016) and the other can be a regionalisation policy, which can address the main sources of incoherence in the governance structure (Vinke-de Kruijf, Dinica, & Augustijn, 2009). According to the results of this research, it seems that in this top-down implementation context, the state level can help to decrease the fragmentation and increase the coherence of the policy implementation.

Mexico is still facing important challenges regarding wastewater treatment. However, some guidelines can be found in this research and the successful national cases, as the context plays a relevant role that is not necessarily aligned with international agendas. Future research is needed to increase our understanding in the role of the state level. Our operationalisation of the GAT is a step towards future WWTP governance assessments in Mexico.

Note

1. They are called *semi*-normative, since their ethical value rests on the appreciation of the goals themselves.

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No potential conflict of interest was reported by the authors.

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