INTERNATIONAL ASSOCIATION FOR THE STUDY OF THE COMMONS

INSTITUTIONAL CONFIGURATIONS FOR URBAN WATER MANAGEMENT IN MEXICO

Abstract ID 1103
User 0757

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Since the application of a decentralized policy for urban water management in the nineties, it has been assumed that municipal authorities could choose between two arrangements: directly managing the service through the figure of a municipal utility or signing a concession contract with a private enterprise. However, looking closely to the real decentralization experience in several Mexican municipalities, we found out that in fact there exist four possible configurations that could be adopted to provide urban water: 1) municipal control by one municipality; 2) intermunicipal association, water management by several municipalities; 3) state control, water management by an organism depending on the state government; and 4) private control, water management by concession to a private firm. In this paper, we propose to discuss the normative framework and the contextual variables shaping the interaction between the actors involved in water management and how this dynamics could make possible governance arrangements based on social involvement for the definition of water management problems and solutions. For this purpose, we examine one example of each institutional configuration through the conceptual framework constructed by Elinor Ostrom and her workshop colleagues.

Key words: water management, institutional arrangements, Mexican municipalities, biophysical world, rules in use, community.

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Introduction

Recent governance models proposed for water management emphasize the involvement of governmental and non-governmental actors in identifying and solving water problems. In the case of natural resources management, the concept of local governance is important because we need to consider the local characteristics in terms of resource availability and the degree in which each locality is constraint to share the resource with other communities or even competing with them for the resource. Thus, natural resource management is a clear example of how public issues are less defined at the federal or national level, with local contexts acquiring a greater relevance in the delimitation and treatment of public problems. That is the reason why social scientist are increasingly talking about problems' territoriality, since public issues "are not anymore centrally defined, they could only be defined near the territory that define their always specific reality" (Duran, 1999: 41). In facing global contemporary problems such as water management we need to consider diversity, in terms of different contexts but also in terms of the institutional arrangements constructed around water issues.

According to this diversity, we find also different actors involved in problem solving each one with a particular vision of the problem, different preferences and different capacities. The fact that they are linked by their use of a common resource creates a relation of interdependence that generally extends in the long term. An efficient governance model would favor the construction of consent and a sustainable use of the resource, both conditions needed to overcome the tragedy of the commons[1].

The Institutional Analysis and Development framework developed by Ellinor Ostrom (2005) and her colleagues provide a set of useful concepts to approach the dilemmas faced by communities linked by their sharing of a common resource. This conceptual framework includes three basic elements to understand an action situation involving a common pool resource (CPR):

- Biophysical world, related to the characteristics of the resource in terms of availability, access and renewal capacities.

- Rules-in-use, referring to the set of rules that shape the exchange between actors in real life, a set or rules that could be complementary or opposed to formal rules intended to influence actors behavior[2].

- Community, the collectivity of actors involved in resource use, linked by interdependence relations. It includes governmental and non-governmental participants with their own interests, resources and world vision.

[1] We are referring to the figure proposed by Harding (1968) about the dilemma faced by users of a common good that applying individual maximization strategies arrive to a negative collective result: the overuse of the resource and its eventual disparition.

[2] Rules-in-use are a well-known concept in institutional and organizational analysis. Authors such as Argyris and Schön (1996) make reference to this kind of rules as an important element that helps to explain organizational behavior. Institutional and organizational scientist that use this term recognize that formal rules are not the only rules that have an influence on individuals and emphasize the fact that in any organization we can find a formal speech defending specific rules (declared theory) coexisting with a set of rules non recognized but that could sometimes be more significant in guiding actors exchange (theory in use).

In this paper, we propose to approach some examples of local water management in Mexico using the IAD framework in order to identify the different arrangements crafted for local water management in Mexico.

1. Local water in Mexico: four management models.

It has become increasingly clear that policy issues related to natural resources require a significant involvement of users in order to achieve goals related to sustainability and the efficient use of the resource. Consequently, for several public services, mainly the ones involving natural resource management, public action could not be considered anymore as exclusively governmental, it has to be approached as an exercise of co-construction between governmental and social actors.

Since the constitutional reform applied in 1983, Mexican municipal authorities are responsible of several urban services, among which we find water management. This reform had two important impacts: it made possible private participation in water management through concession models and it emphasized social participation in preserving the resource. It also transformed the institutional framework, new water agencies were created at the state and local level: state water and sewerage commissions and water municipal utilities. Apparently, the decentralization reform would allow municipal authorities to choose between concession and public management in order to organize water urban use. However, our research has shown that the dilemma of choosing between these two models is much more complex, since local water management in Mexico could adopt at least four modalities:

> **Model I. Municipal control:** In this case, water management is a direct responsibility of municipal authorities through municipal utilities specifically created to assume this task. Decision making concerning key issues for water management happens at the municipal level, even if some specific tasks (such as water treatment) could be performed by private enterprises.
>
> **Model II. Intermunicipal association:** When more than one municipality takes charge of water services for their territories. This kind of water management emerges mainly when several municipalities share a water basin and having a shared management system seems to be a useful policy strategy. However, in general terms, this important decision is not taken by the municipal authorities involved. Since states' capitals are often the core of this association, this decision generally comes from state authorities. Under this figure, an intermunicipal water utility is created, leaded by the municipality being the state capital and including some metropolitan municipalities.
>
> **Model III. State control:** Being a federal republic, Mexico is organized on the basis of 31 states and the Federal District. Water decentralization began with a transfer to state authorities of water services that would eventually lead to a transfer to municipal authorities in order to complete the decentralization scheme. This transfer to the municipal authorities has reached different degrees through the country. In some cases, it has been accomplished showing experiences of failure and success[3]. In some other cases state water provision

[3] Must of state water laws establish that when a municipality is not able to take in charge water services they should be provided by the state authority.

covers almost the total number of municipalities in the state that is the institutional arrangement that we identify as state control.

Model IV. Private management: This scenario emerges once a concession contract is signed in order to allow a private enterprise to manage water service in an urban municipality which is the capital state. Though public municipal authority is still responsible for providing the service and monitoring the enterprise performance, key decisions are taken by the last one. In the early nineties, when the decentralized policy was implemented, this was the privileged model since the goal was to generalize private water management in Mexico.

Nowadays, we are developing a research project aiming to illustrate how these four institutional arrangements relate to the three components in Ostrom's model. This presentation is not about research final results, but about first findings for each case.

2.Characterizing the institutional configurations for water management in Mexico.

We have chosen an example in order to illustrate each management category starting by a general description of the municipality involved in each case. Then, we will describe how the three elements proposed by Ostrom (2005) are present in each case. Finally, we will propose some general ideas that will enrich our research project.

The examples selected for each category are:
Municipal control: Naucalpan de Juárez, municipality of the State of Mexico.
Intermunicipal association: Pachuca de Soto, and other 10 municipalities of the state of Hidalgo.
State control: Monterrey, Nuevo León.
Private management: Aguascalientes, municipality of the state of Aguascalientes.

a) General context of each case.

The municipality of **Naucalpan** makes part of one of the most important states in the country in terms of population, the State of Mexico. According to the territorial division established by the National Water Commission (*Comisión Nacional del Agua, Conagua*), the municipality of Naucalpan belongs to Region XIII, Valley of Mexico Waters (*Aguas del Valle de México*). It is the most populated region in the country, since it includes Mexico City, and the states of Hidalgo, México and Tlaxcala. Naucalpan's urban area covers 43.8% of the municipality. It is a rich, industrial area with many small industries including pharmaceuticals, chemicals, and textile factories.

The municipality of **Pachuca de Soto** belongs to the state of Hidalgo, it belongs also to Region XIII, Valley of Mexico Waters, according to Conagua's classification. In order to manage water service, Pachuca has joined other ten municipalities of the state constituting an intermunicipal utility called Water and Sewerage Commission of Intermunicipal Systems (*Comisión de Agua y Alcantarillado de Sistemas Intermunicipales*, CAASIM)[4]. Agriculture is an important economic activity in most of

[4] The municipalities making part of CAASIM are: El Arenal, Mineral del Chico, San Agustín Tlaxiaca, Pachuca de Soto, Mineral del Monte, Epazoyucan, Mineral de la Reforma, Tepeapulco, Singuilucan, Zempoala and Tlanalapa.

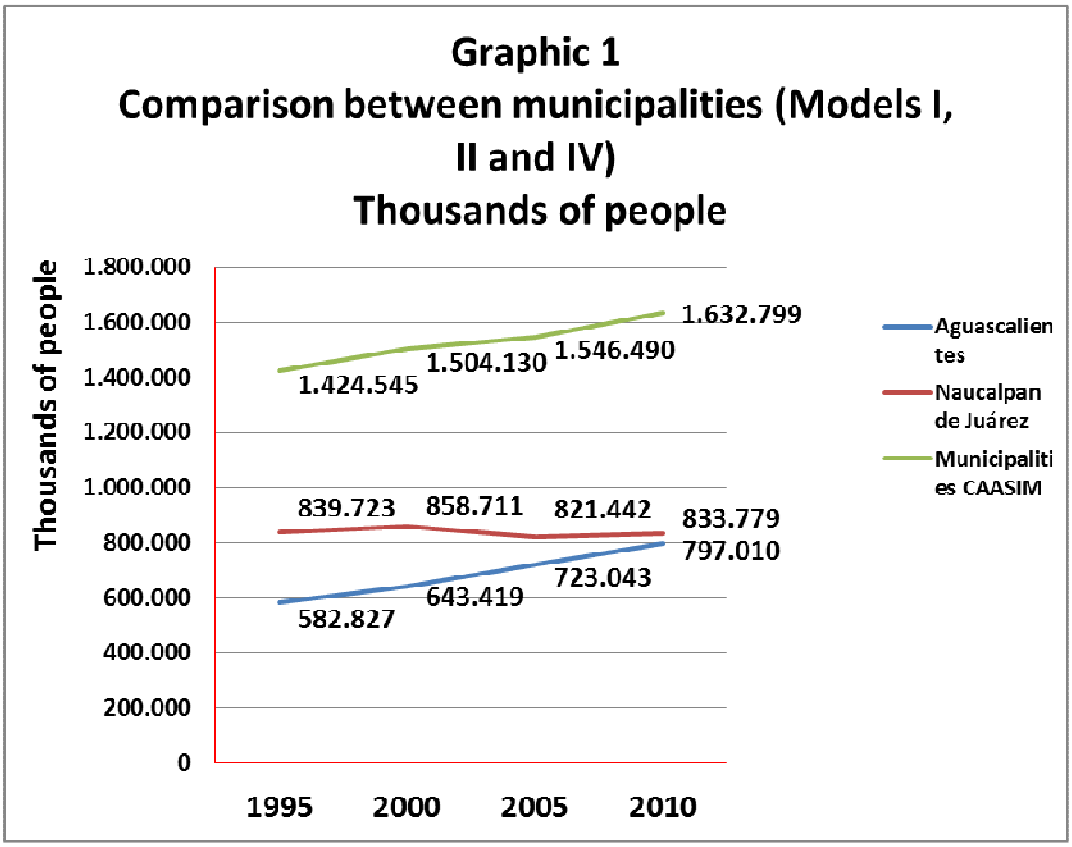
the municipalites, including Pachuca de Soto; some of them have also an important mining activity and the capital has also important commercial and touristic activities.

Our example of state control is the state of Nuevo León, with 51 municipalities, **Monterrey** being the capital of the state. Monterrey is an important industrial municipality, classified as one of the three most important cities of the country. Surrounded by mountains and with an arid weather, Monterrey has the reputation of a modern city, with great influence of the United States. Water management in Monterrey is conducted by Water and Sewerage System of Monterrey (*Sistema de Agua y Drenaje de Monterrey*, SADM), a state agency which is considered as one of the most efficient water utilities in Mexico.

The case of a private concession of water services is illustrated by the municipality of **Aguascalientes**, which is the capital of a small state with the same name, nearby Mexico City. The municipality represents 20% of the territory of the state of Aguascalientes. Given its proximity from Mexico City, some governmental offices have been decentralized to the city of Aguascalientes[5], a measure that increased population growth in the last 20 years. More than 90% of Aguascalientes' population lives in the urban area. Since 1993, Aguascalientes' urban water management is under a concession contract with a private enterprise integrated by an association of a Mexican construction firm called ICA (*Ingenieros Civiles Asociados*) and the French water firm Générale des Eaux (GDE).

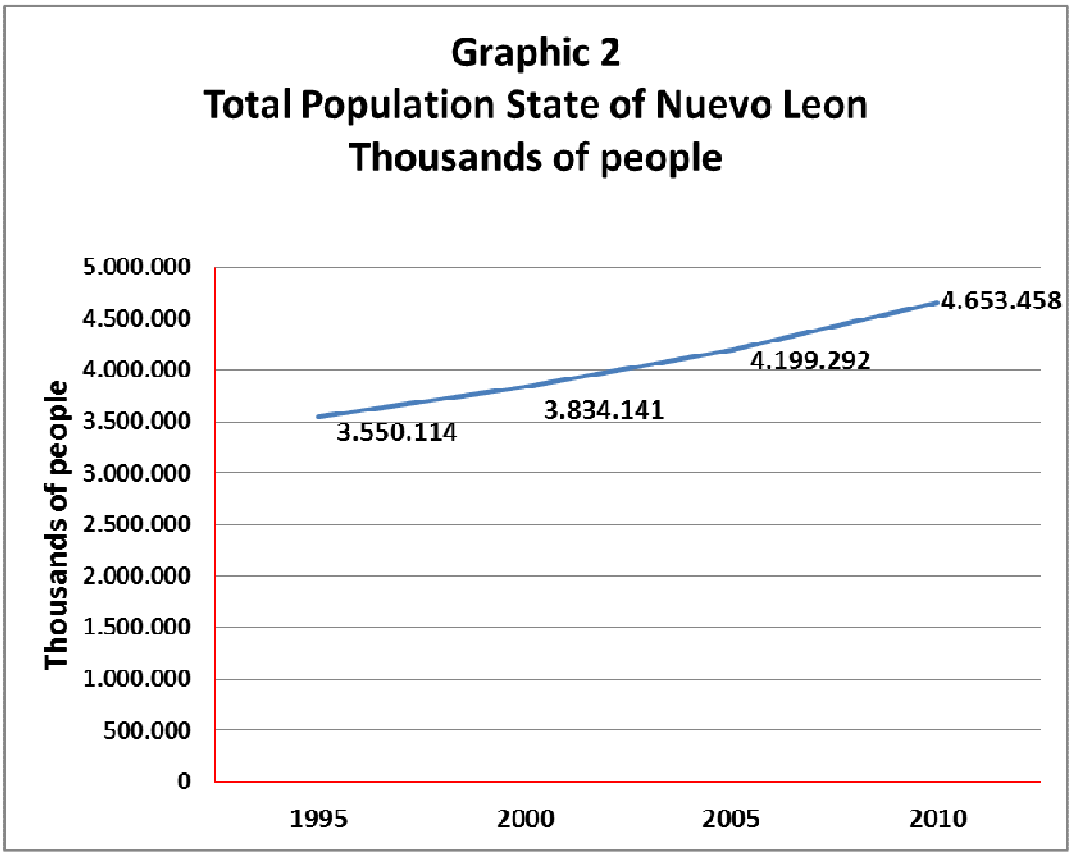
Graphic 1 shows the evolution of population growth for the municipalities involved in models I, II and IV.

[5] The most important example of this decentralization is the case of the public organism charged of national statistical data (*Instituto Nacional de Estadística*, INEGI), which moved to Aguascalientes after the 1985 earthquake.



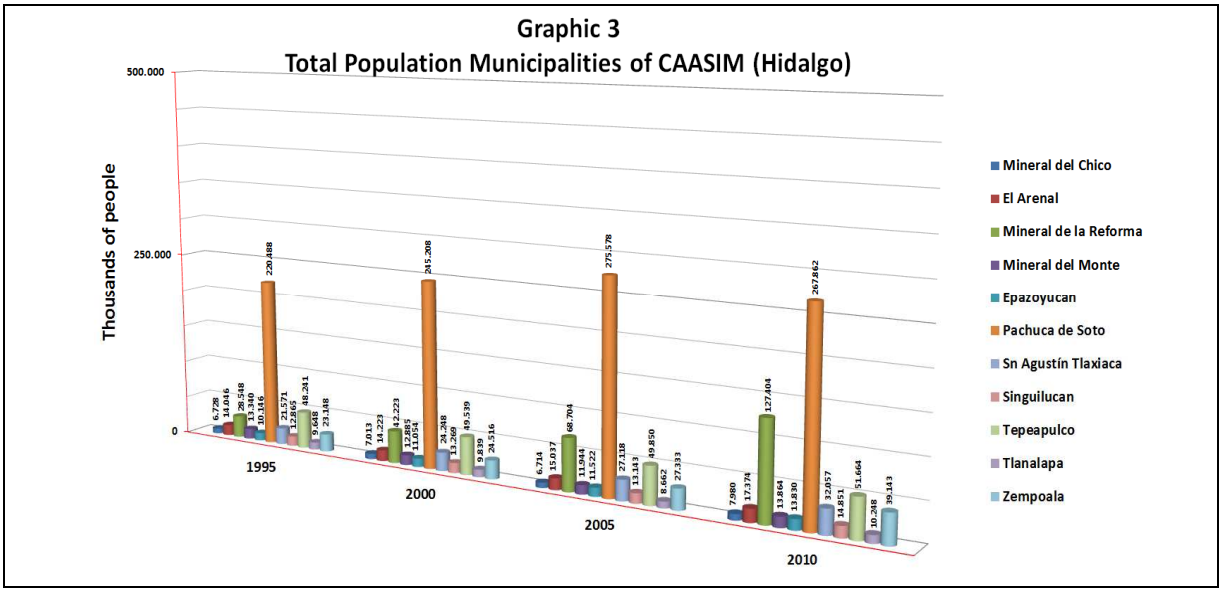
Source: INEGI: http://www.inegi.org.mx.

In Graphic 3 we can observe the case of Nuevo León, where the water management system covers the entire state.



Source: INEGI: http://www.inegi.org.mx.

As a general reference, we have also Graphic 3 which shows population growth for all the eleven municipalities integrated in the water intermunicipal utility called CAASIM, in the State of Hidalgo.



Source: INEGI: http://www.inegi.org.mx.

Concerning population growth, the municipality of Naucalpan is the only one among all four cases that shows a decreasing tendency between 2000 and 2005. The other three municipalities and the state of Nuevo Leon show a constant increasing tendency over time.

b) Biophysical characteristics

We will now go through the main features of the biophysical world surrounding water management in each case. We will mention the sources and geographical conditions that affect water provision.

Although **Naucalpan** has several water sources (rivers, basins and waterholes), the uncontrolled growth of its population has constrained the authorities to extract great quantities of groundwater in order to satisfy the users' demand. Moreover, according to a diagnostic elaborated by the municipal water utility OAPAS, external water sources represent almost 80% of the water for urban domestic usage (Table 1).

Table 1
Water sources
Municipality of Naucalpan de Juárez (2004-2008)

	External water sources		*Local water sources*		*Total*
	Mm³	*%*	*Mm³*	*%*	*Mm³*
2004	70.6	74%	24.9	26%	95.4
2005	70.5	76%	22.0	24%	92.5
2006	69.5	77%	20.4	23%	89.9
2007	67.4	75%	22.9	25%	90.3
2008	65.0	77%	19.9	23%	84.9

Source: OAPAS (2009). *Estudio de Diagnóstico y Planeación Integral para los proyectos de mejora integral de la gestión de los organismos operadores de agua*.

In 2009, Naucalpan received 3,150 liters of water per second (lps), but only 28% (882 lps) were obtained through sources located in its territory; the rest (72%) came from sources outside Naucalpan. The most important external source is the Lerma-Cutzamala system, providing 66.6% (2,098 lps) followed by the Madin barrage (located at another municipality of the State of Mexico) from which 5.4% of Naucalpan's water is obtained (170 lps). Even if the service has a coverage capacity of 98.5%, real coverage attained in 2005 only 97.70%[6], the main difficulty for urban water management is the provision of water for new users settled in recently constructed set of housings. The hydraulic infrastructure in Naucalpan has evolved in response to the urban growth with irregular settlements being the main management problem. In general, the quality of water service is considered good, while at the same time it is recognized that the infrastructure presents lack of maintenance and that the users' census is incomplete.

Water provision at **Pachuca de Soto** has as its main source the Valle Tizayuca basin, with several wells which water is shared with the Federal District and some municipalities of the State of Mexico. Other water sources include small barrages, superficial and underground water and mine water. Hidalgo's geographic characteristics make difficult water distribution, mainly for those municipalities situated far from the main sources. In this case, water main issue is about distribution and not scarcity.

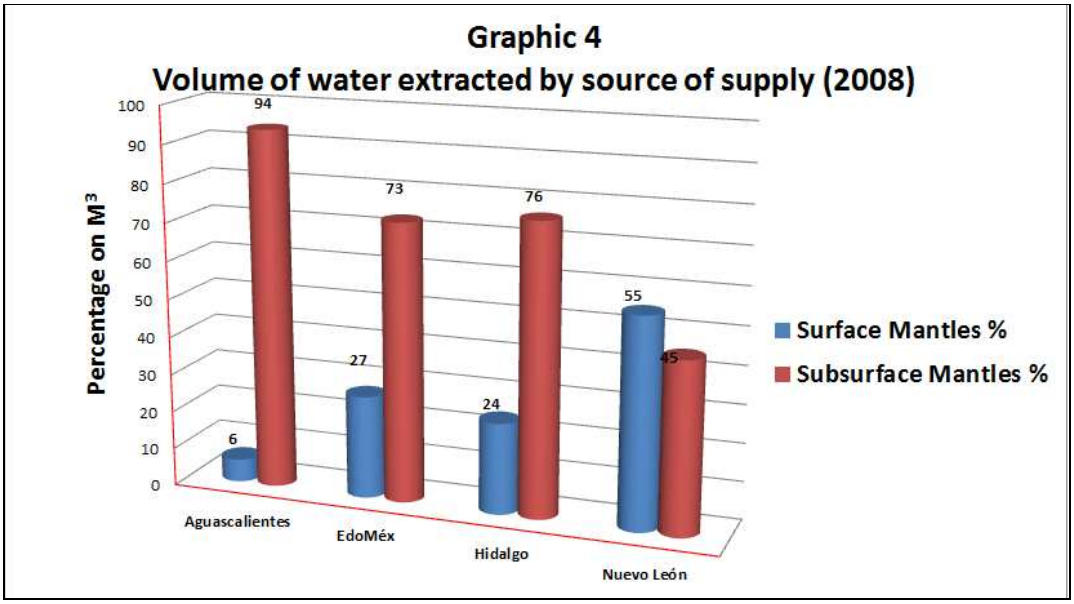
[6] Estadísticas del agua de la región hidrológico administrativa XIII, Aguas del Valle de México, 2009.

However, in the mean term a problem of scarcity could emerge since there are not clear rules to define the sharing of the resource between the state of Hidalgo and the Federal District.

The municipality of **Monterrey** has faced several phases of drought, given the arid climate that characterizes the north of the country. According to the web site of the water system, SADM, water provided to the population of the metropolitan area comes in a 60% of superficial sources and the other 40% comes from underground sources. There are also two important barrages: Cerro Prieto, with a capacity of 300 millions of m^3; and *El Cuchillo*, with a capacity of 1,123 billions of m^3; finally, there are a total of 111 wells and one spring[7]. The main problem related to water in the state of Nuevo Leon is scarcity, with only a few rivers and a low level of rainfalls, Monterrey's hydraulic pressure has increased. Aguilar (2006) refers that until the 1950 water was mainly obtained from underground sources, but successive droughts and population growth leaded to a greater dependence respecting water from different barrages. However the water system is recognized as one of the most efficient in the country.

In the case of **Aguascalientes**, we find a semi-arid climate where scarcity is also the most important issue related to water management. A growing use of underground water has resulted from the over exploitation of superficial sources, depletion of wells and exhaustion of aquifers. Scarcity is not the main water problem in Aguascalientes, but the over exploitation of natural sources that would eventually lead to bring water from other sources, out of the state. In a potential water conflict in the central region of the country, Aguascalientes could also get involved if water demand is not controlled.

Graphic 4 shows water extraction for all the four states where our examples are situated. It is remarkable how underground water represents the highest percentage in all four cases. In the case of underground water, the highest level of extraction is represented by Aguascalientes (94%) while the lowest rate is represented by Nuevo León (45%).



Source: INEGI (2008). *Panorama censal de los organismos operadores en México*.

[7] SADM web site: http://www.sadm.gob.mx/PortalSadm/jsp/seccion.jsp?id=141

Since Aguascalientes represents the private management model and Nuevo León the state control model, a hypothesis in this sense could be that the private model does not contribute to overcome the dependence on underground water. Concerning Hidalgo and the State of Mexico, they both belong to the central region of the country and face similar water conditions. However, the municipalities studied have chosen different management models, since Hidalgo has an intermunicipal association and the municipality of Naucalpan de Juárez has a municipal water management. A second hypothesis could be that the biophysical conditions related to the resource availability were not a relevant issue in deciding which model of water management would be adopted.

c) Rules in use

Our field research will be further developed in the following months. Meanwhile, we start our analysis of each case through a general review of the formal rules that constitute the institutional arrangement for water management and some stylized facts exemplifying the interactions between governmental and non-governmental local actors. In Mexico each state has its own water law, the main local instrument in order to regulate the use of hydrological resources that could be completed by other more specific documents such as concession contracts or agreements

For the **State of Mexico**, some of the relevant actors are the local office of the National Water Commission, the local Ministry of Water and Public Works and the Water Commission of the State of Mexico. Naucalpan's water utility is called Drinking water, sewerage and sanitation utility (*Organismo de Agua Potable, Alcantarillado y Saneamiento,* OAPAS).

At the municipal level, the law creating the public water utility (OAPAS) establishes that it is an autonomous agency for water management in the municipality of Naucalpan de Juárez. Inside the organization, decisions are taken by an administration board which includes representation of civil society, industrial and commercial users, and a representative of the municipality. Attributions of OAPAS include:

- Definition of strategies and parameters for water management in Naucalpan.
- Proposal capacity for making adjustments to the local regulation of OAPAS' activities.
- Authorization or removal of OAPAS' Director.
- Authorization of the organic structure needed to accomplish the tasks charged to OAPAS.
- Acceptance and revision of the annual reports presented by OAPAS' Director.

The Director of OAPAS is appointed by the municipal president. The Director is charged of managing and controlling the administrative units composing the public water utility. He is also responsible of proposing OAPAS annual budget and presenting reports to the administration board.

In the state of **Hidalgo**, there is a regional office of the National Water Commission that has its base in the capital city, Pachuca de Soto. Other relevant governmental actors are the State Water and Sewerage Commission (*Comisión Estatal de Agua y Alcantarillado*) and the intermunicipal utility called CAASIM. The local law is the State

Water and Sewerage Law for the State of Hidalgo published in 1999, one important characteristic of this law is that it allows municipalities to join efforts to manage water services under the figure of an intermunicipal utility. This choice is not included in all of the state water laws. CAASIM's general director is pointed out by the state governor, just as general directors of municipal water utilities are pointed out by the municipal president.

Consequently, there is a strong relationship between the state government and the utility charged of water management. However, according to the information obtained through the field research, there is not a good level of coordination between them. Since the urbanization process of Pachuca continues, state government has taken decisions of housing construction without consulting CAASIM. This situation has generated problems of capacity in water network, because CAASIM is not ready to cover those housing not included in their planning. On the other hand, associating with smaller municipalities has represented both an advantage and a disadvantage. The advantage being that serving a great number of population gives the intermunicipal utility a strong political argument for demanding the support of the state government; at the same time, the disadvantage is that having partners with less financial power a great part of the budget comes from the capital funds and the goal of autofinancial capacity gets difficult to achieve.

In the case of Monterrey there is also a state law, called Water and Sewerage Law for the State of **Nuevo León**. As part of the normative framework, there is also a specific instrument for regulating the water utility activities, the Organization Manual for the Provision of Water and Sewerage Services in Monterrey. SADM, which provides water and sewerage services for the whole state since 1995, is considered as one of the most efficient water utilities in Mexico. It is managed as a public enterprise, with an administration board that has a strongly technical approach to the service. Some of SADM's functions according to their web site are:

- Provide public water and sewerage services for all inhabitants of the State of Nuevo León.
- Operate, maintain and manage water superficial and underground sources
- Provide a confident service, through the definition of policies and strategies for extraction and managing of potable water.
- Take in charge planning and searching for new water sources, for the metropolitan area and the whole state territory.

For municipal water utilities, the general director is appointed by the municipal president. In the case of this state water utility, the state governor preside SADM's administration board. The most important water conflict that has taken place in Monterrey is the one concerning the barrage named *El Cuchillo*, a conflict that involved farmers from a neighboring state called Tamaulipas, in fact it was a conflict between agricultural and domestic use aggravated by a previous drought period. According to Aguilar (2006), this controversy was partially solved thorough a negotiation between the two state governments and the national government, where the two states agreed rules in order to share the water of *El Cuchillo* basin and established compensation water fees for Tamaulipas' farmers.

In the case of **Aguascalientes**, as a general normative framework there is also a local law called Water Law for the State of Aguascalientes. It is complemented by the concession contract signed with CAASA (now called *Proactiva Medio Ambiente)*. The original contract signed in 1993 was modified in 1996 enforcing the conditions under which the concession was signed. Recent modifications in the state water law maintain the attribution of the private firm of defining water tariffs, under supervision of the state agency responsible for hydrological resources and requiring to be approved by the municipal council. In terms of interaction between actors involved in water management, according to the information obtained in our field research, the private enterprise is highly independent and has a good efficiency level. However, past experience has demonstrated that in case of conflict the enterprise searches for support in the state government and even the federal government. A clear example was the attempt of recovering water service on behalf of the municipal government in 1996 which failed because of the lack of a solid argument to take water management off the hands of the private firm. Conflict between the private firm and municipal authorities was solved through the mediation of some federal actors leading to a renegotiation of the concession contract. This situation indicates that the municipal authority has low influence in solving matters related to water service.

d) Community characteristics

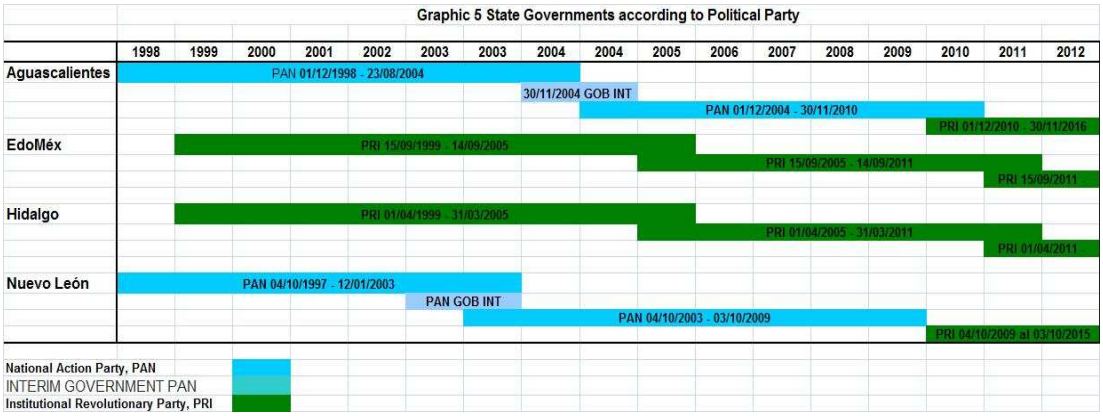
As a third element of the analytical framework we find the characteristics of the community sharing the resource. In the case of the State of Mexico, Hidalgo and Aguascalientes, we have traditional societies with low levels of social participation in public issues. Table 2 shows citizens' perception of influence in political life on behalf of different social groups, according to the National Pool about Political Culture and Citizen Practices 2012 (*Encuesta Nacional sobre Cultura Política y Prácticas Ciudadanas,* 2012).

Table 2
Perception of political influence, municipal level
2012

	Enterprises	*Political parties*	*President of Mexico*	*Unions*	*Citizen associations*	*Individual citizens*
Aguascalientes	Strong	Strong	Strong	Weak	Weak	Weak
Mpio Hgo	Strong	Weak	Strong	Strong	Strong	Strong
Mpio N. León	Strong	Strong	Strong	Strong	None	None
Naucalpan	Strong	Strong	Strong	Strong	Weak	Weak

Source: National Pool about Political Culture and Citizen Practices, 2012.

At the state level, Aguascalientes and the State of Mexico, particularly, are among the states that have always been governed by the Institutional Revolutionary Party (*Partido Revolucionario Institucional*, PRI). Graphic 5 shows the late government periods at the state level, we can notice that the State of Mexico and the state of Hidalgo have maintained PRI governments, while Aguascalientes and Nuevo León had a 12 year period of National Action Party (*Partido Acción Nacional*, PAN) government, with a come-back of the PRI in 2010 and 2009 respectively. It is remarkable that in the municipalities of the State of Mexico, citizens consider that their own influence in political life is weak; however, at the state of Hidalgo, with a similar dominance of PRI, citizens consider that they have a strong influence in political life.



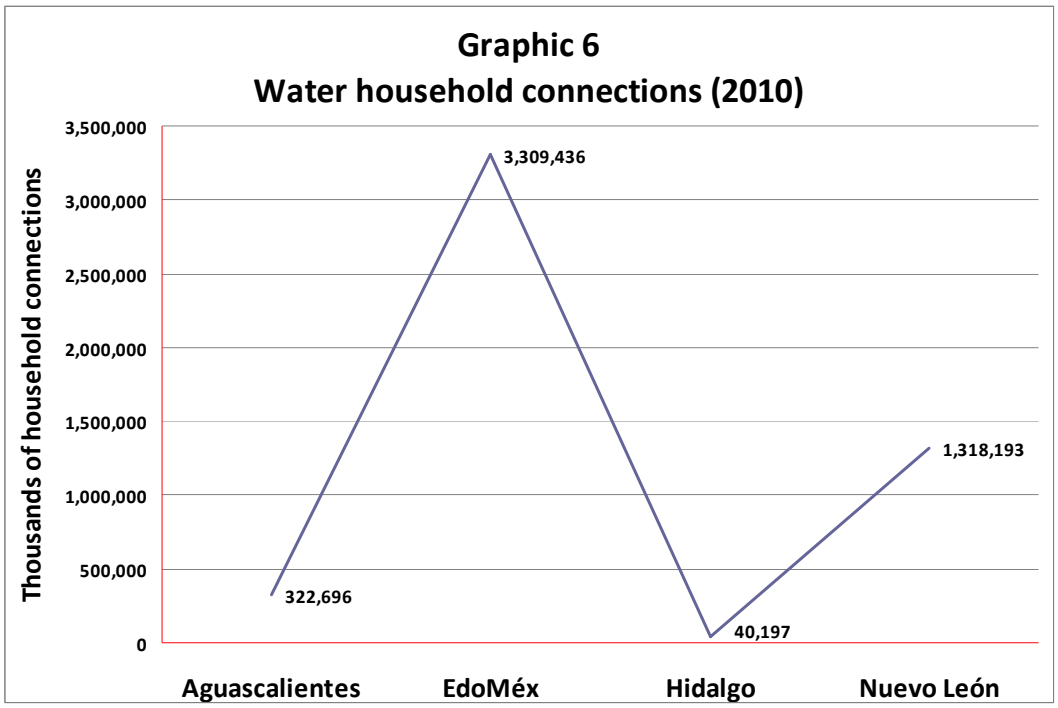
Source: *Conferencia Nacional de Gobernadores* (conago.org.mx).

We can also observe that in the case Nuevo León, citizens consider that they have no influence in political life, either through an association or individually. This is surprising data since Nuevo León is characterized as a dynamic, entrepreneurial society and we could expect citizens with a higher self-confidence to get involved in social and political life.

It is important to mention that at the local level the municipalities of Naucalpan and Aguascalientes have already been governed by the conservative party (PAN). In fact, in the case of **Aguascalientes**, urban water was a very significant issue since the PAN candidate offered to take off water service from the hands of the firm and to manage water through a municipal water utility. Although finally it was not possible to attain this goal, this experience demonstrated the relevance of water issues for the society of Aguascalientes. In the case of **Naucalpan**, at this stage of our research we have not found any evidence of water issues as a relevant subject in election seasons.

We can conclude that in terms of community characteristics the likely of citizens organizing by themselves in order to participate in decision making concerning water issues is low. However, as far as water becomes a priority for citizens all over the country and with the increasing concurrence for the resource between users and between states and municipalities, we would suppose that social participation would become more relevant in discussing and solving water problems. In any case, according to these data we could make the hypothesis that citizens did not participate in the decision concerning the model of water management that has been adopted. According to the rules in use, it is more likely that this decision had been taken by governmental authorities in all four cases.

Finally, as a way of assessing the impact of each management model Graphics 6 and 7 show the number of household connections existing in the four states and water coverage in the eleven municipalities of the state of Hidalgo respectively.



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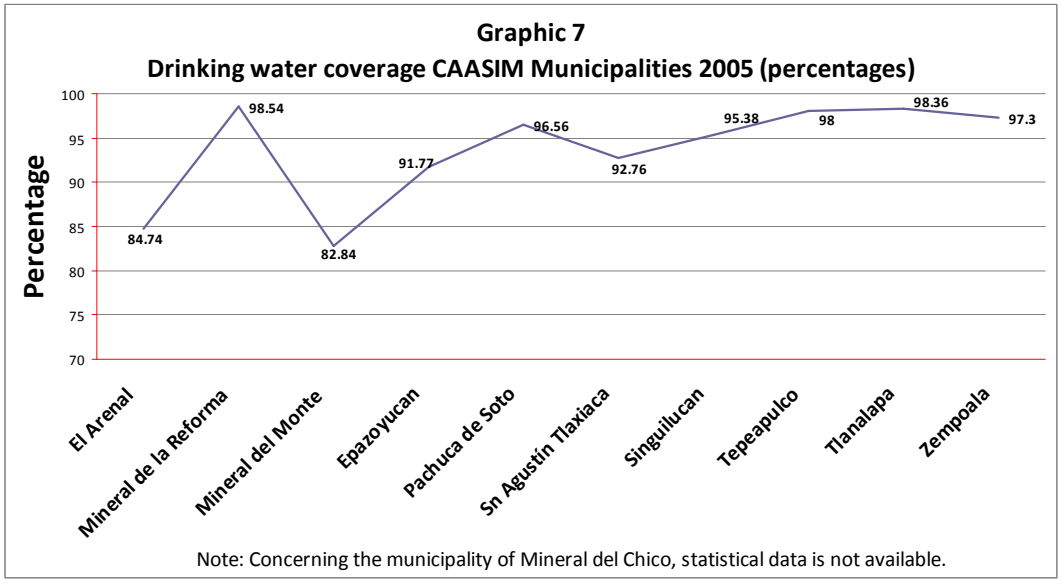


Source: INEGI: http://www.inegi.org.mx.

We can appreciate a good level of service coverage in all four cases. Further research will be needed in order to establish which variable influences management results in a more significant way.

CONCLUSION

Despite the idea that the decentralization of water services would result in a choice for municipal authorities between public or private management, our research work has demonstrated that in fact Mexico has at least four institutional arrangements for

managing urban water. Looking at the elements proposed by Ostrom's IAD analysis framework we can conclude that the biophysical characteristics were not determinant in choosing between the four arrangements; the rules in use were more relevant in taking this decision.

The action situation for each case is illustrated by Figures 1 to 4. The first figure shows the general scheme proposed by Ostrom (2005) as an analytical framework for studying action situations.

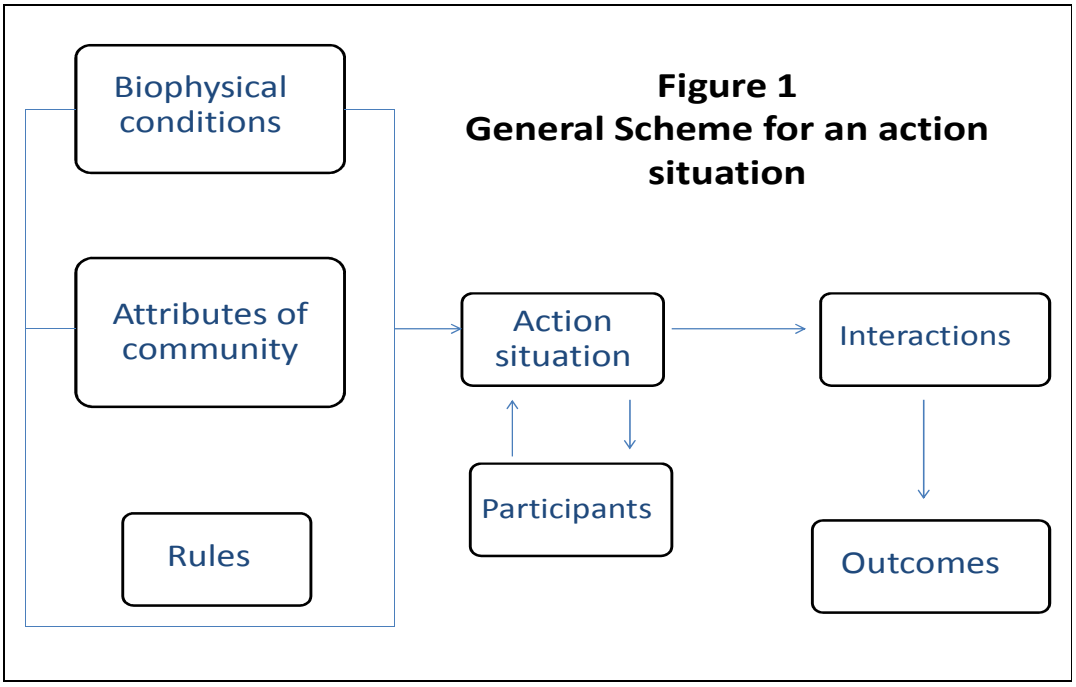
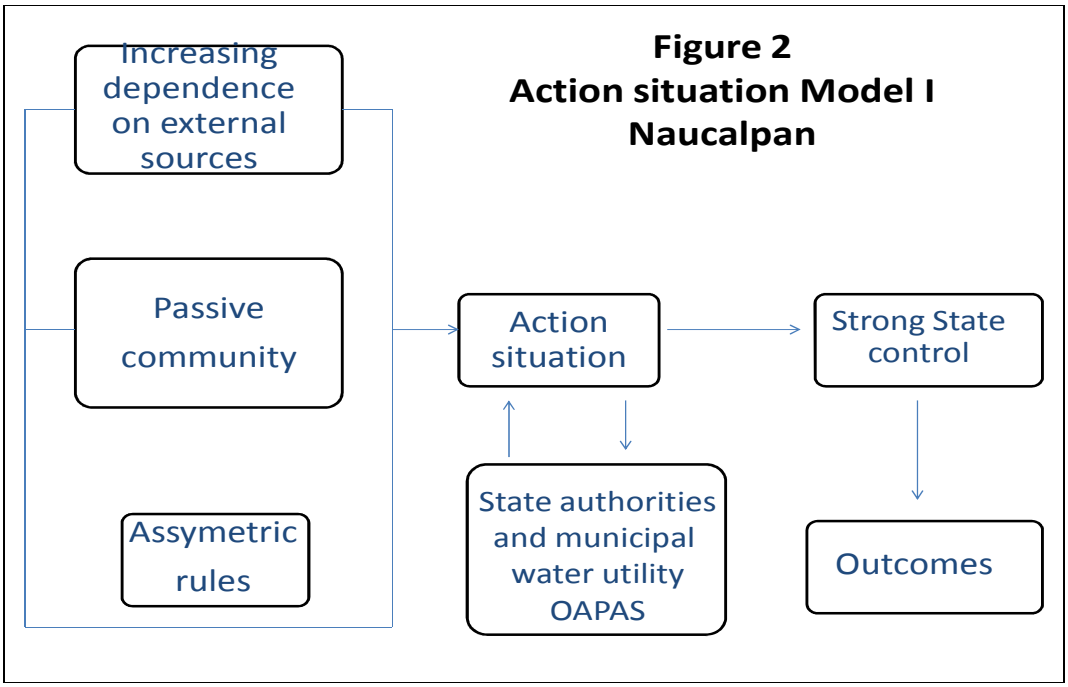
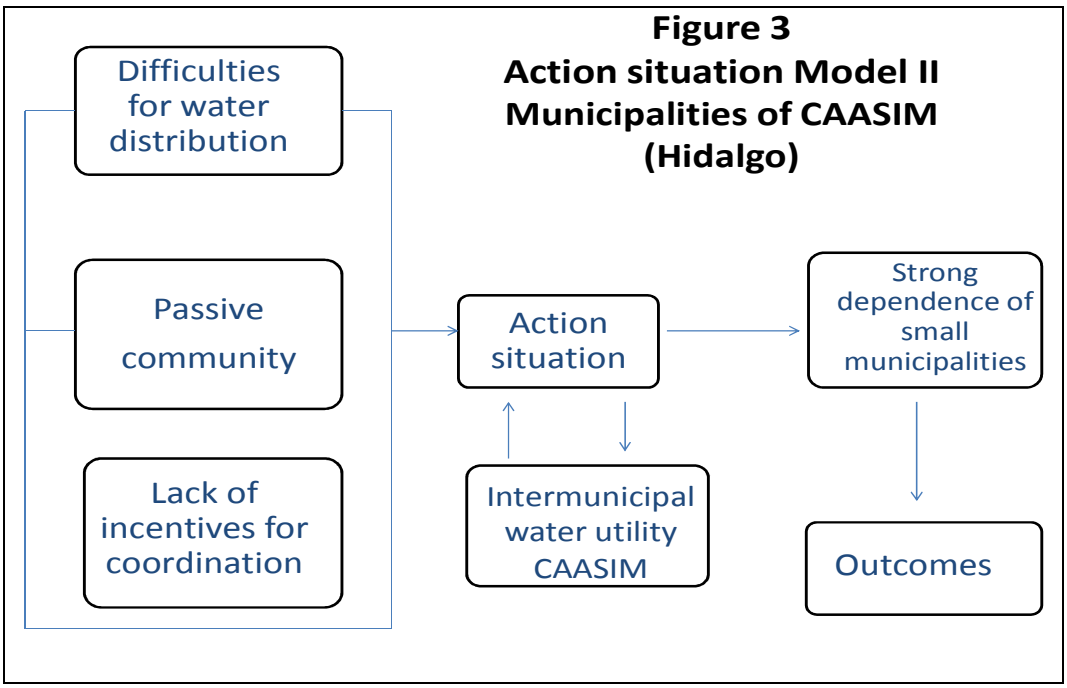


Figure 1
General Scheme for an action situation

Figure 2 shows the same scheme applied to our case of Model I, where a municipal water utility is charged of managing the resource. In every specific figure we will consider that the action situation concerns water management. We do not discuss outcomes since we need go deeper in our research work in order to establish a relationship between the institutional arrangement and their efficiency in solving water issues. What we can observe at this stage of our research is that the interactions resulting from each institutional arrangement are different and not necessarily congruent with a decentralized policy. For example, in the case of Naucalpan (Model I), the existence of a municipal water utility has not resulted in a stronger position of municipal authorities for decision making about water issues. This could be attributed partially to the asymmetric rules framing interactions and to the passivity of the community that seems not to be interested in getting involved in decision processes.



Model II is illustrated in Figure 3, with the example of the intermunicipal water utility called CAASIM. In this case we consider that the most important element defining interactions is the lack of incentives for a coordinated action between actors involved in water management, mainly governmental actors. Although we could expect that an intermunicipal figure would empower participant municipalities, the final result is a bounded action capacity on behalf of CAASIM, constrained by state governmental actors.



The example of Model III (state control) is illustrated by Figure 4. We can observe that even if the local water utility is managed as a firm, its strong links with the state government do not correspond to the explicit goal of the decentralized policy of empowering municipalities for water management.

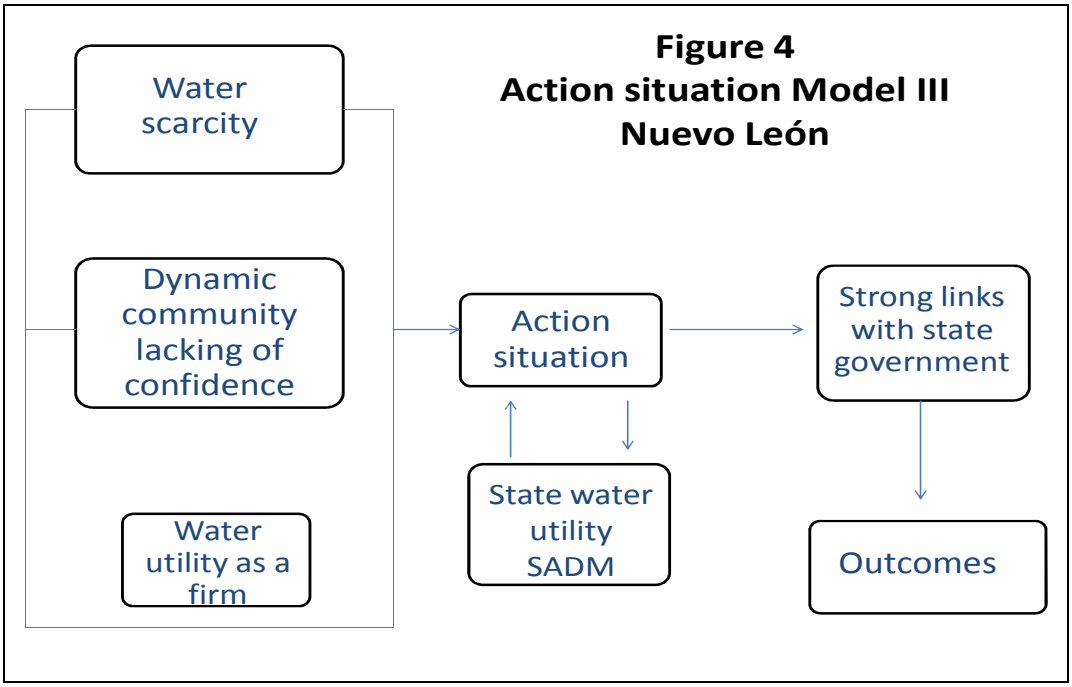


Figure 4
Action situation Model III
Nuevo León

Our last model (Model IV, private control) is shown in Figure 5. Once again, we consider that the main feature of the interactions in this institutional arrangement results of the combination of a passive community and rules in use giving advantages to the firm. And once again this model does not contribute to empower the municipality.

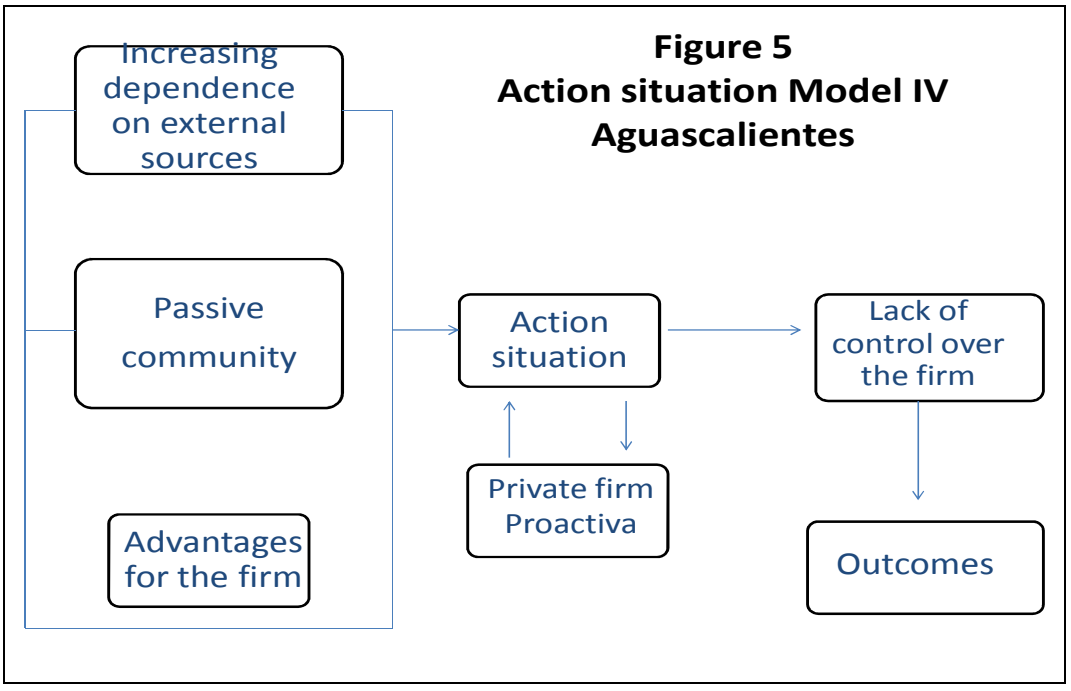


Figure 5
Action situation Model IV
Aguascalientes

As a general conclusion we could state that in the four cases, the significant variables framing actors' interactions are the characteristics of the community and the rules in use, more than the biophysical conditions of water resource. However, the relative weight of each variable could change, particularly in those regions where a major water crisis is likely to emerge. Further development of our research project will help for a finer analysis of factors involved in each case.

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