

Decentralization, consolidation, and crisis of urban water management in Mexico
Descentralización, consolidación y crisis de la gestión urbana del agua en México

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Abstract

In Mexico, a process of decentralization of potable water services has been developed. It was considered to be consolidated with the transfer of responsibility from the federal and state spheres to the municipal level. The objective of this article is to describe how this transition was carried out until its consolidation and subsequent crisis. This is considered in light of the main management indicators of water utilities.

Keywords: decentralization of public services, drinking water in Mexico, water utilities.

Resumen

En México se ha llevado a cabo un proceso de descentralización de los servicios de agua potable, mismo que se considera llegó a su consolidación una vez que se estabilizó la transferencia de responsabilidad de las esferas federal y estatal a la municipal. El objetivo del presente artículo es describir cómo se llevó a cabo dicha transición hasta su consolidación y posterior crisis. Lo anterior se

reflexiona a la luz de los principales indicadores de gestión de los organismos operadores de agua.

Palabras clave: descentralización de servicios públicos, agua potable en México, organismos operadores de agua.

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Introduction

Water management for urban use in Mexico underwent a decentralization process in the mid 1980s, the result of a global effort led by international organizations (Rolland & Vega, 2010). The objective, as pointed out by Verhoest, Van Thiel, Bouckaert, and Laegreid (2012), was to make the government more efficient in its various tasks, such as solving administrative matters, implementing processes, regulating markets and sectors, and providing public services.

Although the spirit of decentralization advocated the administrative autonomy of public bodies in order to increase their efficiency, in Mexico, decentralization never separated the functions of the agencies from political interests. Therefore, the underlying objectives could not be achieved. That is to say, we opted for what was favorable to the political authority and not for what was most useful for the society (Boehm, 2005, Arias & Caballero, 2003). For this reason, low performance has been corroborated in most agencies (Contreras, 2007). The objective of this article was to describe the process of decentralization of water management in Mexico, including the creation and consolidation of the water utilities, and the subsequent crisis.

This document is divided into four parts. The first mentions the causes of decentralization and the means by which it was carried out. In the second, the consolidation of this decentralization is discussed, including the creation and operation of municipal water utility agencies in most of the states of the Mexican Republic. The third section explains the crisis these organisms have undergone. Finally, it closes with a few brief conclusions.

Decentralization

As Pineda and Salazar (2008) point out, the type of system resulting from the Mexican revolution was notably centralist. With respect to the provision of water, this centralizing tendency was formalized when the Federal Law of Sanitary Engineering was published in the Official Gazette of the Federation on January 3, 1948. This empowered the Secretariat of Hydraulic Resources to manage the drinking water and sewerage systems, while the federal government was involved in the construction of hydraulic works (Dau, 2008). That same year, the General Directorate of Potable Water and Sewerage (DGAPA) was created, under the Secretariat of Hydraulic Resources (SRH). This agency was in charge of "the construction and operation of most of the drinking water and sewer systems in Mexican cities" (Pineda & Salazar, 2008, p.71). The General Directorate of Potable Water and Sewerage (DGAPA) directed these functions through the Federal Potable Water Boards. These were created through a regulation published in the Official Gazette of the Federation on March 5, 1949, and were composed of five members, one of whom was a representative of the Secretariat of Hydraulic Resources (SRH), who "was in charge of the budget, defining the rates and collecting them, and the service and the technical direction of the works" (Pineda & Salazar, 2008, p.71). That is to say, although the meeting included a representative of the state government, the municipal government, and two from the private sector, the most important decisions were made by the representative from the federal government.

As cities grew rapidly, the Secretariat of Hydraulic Resources (SRH) promoted the participation of the federal government in the construction of hydraulic systems in the municipalities. This was achieved through the Law on Cooperation for the Provision of Potable Water to Municipalities. Later, in 1971, the General Directorate of Operations of Potable Water and Sewerage Systems (DGOSAPA) was created, with the purpose of supervising and operating the country's hydraulic systems (Pineda & Salazar, 2008). This office included, in 1976, 34 delegations and a regional headquarters, 873 federal boards, 146 municipal committees, and 37 administrative committees (SRH, 1976 in Pineda & Salazar, 2008).

Pineda and Salazar (2008) pointed out that one of the factors that motivated decentralization was that the General Directorate of

Operation of Potable Water and Sewerage Systems (DGOSAPA) did not have the authority to meet the demands of the growing population. Another factor was a perception that the federal government was solely responsible for providing the services. To illustrate this situation, these authors state, from a report from the Secretariat of Agriculture and Hydraulic Resources (SARH) (1976, p.291), that requests were made to increase the time of continuous service and provide more intakes and better quality water. However, increases in rates and better measurement systems were not accepted, leaving aside improvements to the system.

Table 1. Evolution of drinking water and sewerage systems, 1948-1983.
Source: Pineda & Salazar (2008) based on official documents.

Year	Event
1948	The Secretariat of Hydraulic Resources (SRH) creates the General Directorate of Potable Water and Sewerage (DGAPA).
1949	The Regulation of the Federal Potable Water Boards is issued.
1956	The Law on Cooperation for the Provision of Potable Water to Municipalities is approved.
1971	The Secretariat of Hydraulic Resources (SRH) creates the General Directorate of Operation of Potable Water and Sewerage Systems.
1976	Their functions are transferred to the Secretariat of Human Settlements and Public Works (SAHOP).
1980	The management of drinking water supply systems is transferred to the states.
1982	The new Secretariat of Urban Development and Ecology assumes the function of public works and infrastructure.
1983	A constitutional amendment to Article 115 transfers the management of drinking water and sewage to municipalities and states.

In 1976, the functions of the General Directorate of Operation of Potable Water and Sewerage Systems (DGOSAPA) concerning drinking water and sewerage were transferred to the Secretariat of Human Settlements

and Public Works (SAHOP). This freed the Secretariat of Hydraulic Resources (SRH) to focus on major hydraulic infrastructure works, such as dams and irrigation districts (CNA, 1990 in Pineda & Salazar, 2008).

In 1980, the management of some drinking water systems was transferred to the states in order to decentralize the service. In turn, some states did the same with municipalities (Pineda & Salazar, 2008). This trend was promoted on February 3, 1983 with the approval of the amendment to Article 115 of the Constitution, which established that drinking water services would be the responsibility of the municipalities, although with the option of state support, if necessary. On September 26, 1983, an agreement was published in the Official Gazette of the Federation to transfer the construction and administration of the hydraulic systems to the state governments (Pineda & Salazar, 2008). Collado (2008) mentions that nothing was specified about the financing of these systems. Pineda and Salazar (2008) consider the idea that the states would be responsible for the water service in the event that the municipalities were unable as a type of "security device." In 1982, President De la Madrid created the Department of Urban Development and Ecology (SEDUE) in order to take charge of the urban hydraulic infrastructure.

The 1983 reform was a situation "for which the local government was not prepared. In many cases, the transfer of the water service meant the duplication of the budget and the functions of the municipal government" (Pineda and Salazar, 2008, p.74). This municipalization, promoted by the government of Miguel de la Madrid, was not as successful as expected, in regards to water. Far from resources, what was actually handed over to the municipalities was "a problematic service that required large investments, great technical capacity, financial management, and income from fees that were much lower than the operational needs, let alone the investment" (Pineda & Salazar, 2008, p.74). For Rolland and Vega (2010, p.168), "in reality, this constituted more of a way to reduce the economic and administrative burden of federal power in this matter than to reduce federal control over the sector." Responsibility was transferred to the municipalities, but without the resources to assume it.

Decentralization gradually occurred. Pineda and Salazar (2008), with data from the National Water Commission (CNA) (1990), mention that for 1988, water in 21 of the 32 states was under the administration of state governments, while in the other 11, it was administered by municipal governments. The presidency of Carlos Salinas de Gortari created the National Water Commission (CNA) in 1989. Rolland and

Vega (2010) highlighted that it is paradoxical that decentralization was structured through a national agency.

An important advance in these new reforms was "the allocation of the drinking water service to agencies specialized in the operation of this service, with administrative autonomy and financial self-sufficiency" (Pineda & Salazar, 2008, p.76). These operating agencies may fall under municipality or state authorities, but they are intended to be administered according to business principles of efficiency, although in practice they do not always have all the freedom and resources to act in this way. It should be noted that, "in recent years, the State Water Commissions have come to serve as a counterweight that could facilitate the decentralization of decisions and resource management, at the same time giving technical, economic, and administrative support to the municipalities" (Guerrero, 2008, p.234). This takes on greater importance when the municipalities are small and do not have the resources to provide quality service.

By 1996, the service had been municipalized in 21 states, in two of them the service was provided jointly and in nine others (Baja California, Durango, Jalisco, Nuevo Leon, Queretaro, Quintana Roo, Tabasco, Veracruz and Yucatan) it was the responsibility of the state government (Pineda & Salazar, 2008).

In short, and as will be seen later, this decentralization has been very controversial and limited in terms of water management performance outcomes, as it gives the local authority more responsibilities than resources to meet these commitments. It could be stated that this process of decentralization has been consolidated, because the municipalization of the service has stopped. That is, water management in a minority of the country's municipalities continues to depend on the state, while in the greater part of the territory it depends on the municipalities. The following section will describe the institutional framework resulting from decentralization and the consolidation of water utilities.

Consolidation

By the year 2000, there were 360 operating organizations, most of which were municipal. Meanwhile, at the state level, organizations were

consolidated with the slogan of supporting municipalities with low capacity (Martínez, 2006). Currently, one can speak of the consolidation of decentralization due to the fact that most of the existing water service providers in the country are municipal. At the end of the last decade, there were 435 water utilities in Mexico (Barkin, 2011), mostly under municipal authorities. Few agencies have a metropolitan or state administration. Most of the approximately 2 440 municipalities in Mexico do not have an operating agency, but receive support from their respective state commissions.

The operating agencies were created to resolve problems that have existed throughout much of modern history in our country, moving from the political management of the service to one that is more technical and business-oriented. The "ideal" concept behind these agencies could be summarized by the following objectives (Pineda & Salazar, 2008): autonomy (legal authority and own assets), democratization of administrative councils (encourage the real participation of citizens), reinvestment of resources collected in the collection of water, approval of fees by boards of directors and not by state legislatures, financial self-sufficiency, and greater technical and administrative capacity.

The consolidation of the decentralization of water management in Mexico has not reached the ideal profile mentioned above and has not generally resulted in good performance. For Barkin (2011, p.541), most of these organizations are "small makeshift agencies, composed of personnel with little administrative experience and less technical capacity. Their directors dole out political favors or take advantage of their appointments in order to climb the political hierarchy."

For Contreras (2006), the institutional framework in which water providers operate does not promote efficiency, the key actors do not aim for good performance, and the methods and criteria chosen do not take into account technical factors. This institutional framework consists of both formal and informal rules. Table 2 summarizes these rules.

Table 2. Institutional framework for water management for urban use in Mexico. Source: Own, based on Contreras (2007).

<p>Formal rules Organizations (Contreras, 2007)</p>	<p>Informal rules</p>
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<u>Federal level</u> - Constitution, National water law / CONAGUA	- <u>Seeking political - electoral benefit</u> - Large works - Differentiated service
<u>Regional level</u> - State laws / State water commissions (CEAs), basin organizations	- Avoidance of political - electoral cost - Inadequate rates - No penalties for non-payment - Administration influenced by political cycles
<u>Local level</u> Internal rules of water providing organizations / Organizations providing the service, local town councils and congresses (rate determination), rate advisory councils, researchers, user organizations.	- High turnover of managers - Lack of continuity and long-term vision - Corruption - Inflated Payroll - Illegal kickbacks - Bribes - Imbalances - Poor service efficiency - Unwillingness of users to pay

As formal rules, the laws, regulations, and organizations correspond to three levels (Arzaluz, 2011, OECD, 2013, Contreras, 2007): federal, regional, and local. At the federal level, the National Water Law regulates the exploitation and use of the resource throughout the Mexican territory. The National Water Commission (CONAGUA) is responsible for proposing water policy, establishing water regulations, planning infrastructure, and administering federal resources. CONAGUA is the most important institution in terms of the management of the water sector in Mexico. It is made up of central offices located in Mexico City, basin organizations in 13 hydrological-administrative regions, and 37 hydrological regions (Rolland and Vega, 2010). In 1998, the National Association of Water and Sanitation Companies (ANEAS) was created. This entity was established to transform government entities into real water companies aimed at being efficient and self-sufficient (Pineda & Salazar, 2008). In terms of region, there are state laws that regulate the administration of water resources at that level. State commissions regulate and plan water use in the 32 states. The basin organizations

are responsible for carrying out regional programs, guaranteeing the sustainability of the basins, managing their resources, and acting on interstate issues. At the local level, there are the regulations of the water utilities and very important actors, such as town councils and local congresses (who are, in most cases, the ones that determine fees), advisory councils, researchers, and user organizations.

As informal rules, which are not written but are tacit norms for action in most of the national territory, we find the following:

- Search for political - electoral benefit. Political benefit is sought through building large hydraulic works that favor certain groups, instead of carrying out work that is more necessary but results in less electoral gain, such as the rehabilitation of water distribution networks. In addition, as Monforte and Cantú (2009) point out that the deficiency in water services arises from political problems, as the governors seek to meet the needs of people with greater economic power, because of their greater political influence.
- Avoidance of political - electoral costs. Unpopular actions that may make voters uncomfortable are avoided, such as an increase in rates, penalties for non-payment by cuts or reductions in water supply, and digging up streets to repair networks. With respect to the rates, they are designed for self-sufficiency because the judicial power considers water to be a right, rather than a product. For this reason, in most cases (22 states at the end of the last decade) rates are approved by the council, congress, or both (Pineda, 2011). It is difficult to increase rates because the authorities suffer political costs, as people identify the council or the congress with the authority in charge of the executive. Approving rates due to factors that respond more to political benefits than to technical needs and cost coverage is often mentioned in the international literature (Pineda & Briseño, 2011, Ehrhardt & Janson, 2010, Gingley & Ralston, 2010, Braadbaart, Van Eybergen & Hoffer, 2007, Savedoff & Spiller, 1999, Yepes & Dianderas, 1996). With respect to penalties for non-payment, in Mexico only eight of 32 states suspend service to domestic users who do not pay for the service (Pineda, 2011). However, we find a lack of equity here, since it is the poor who pay more for the water they consume, which is of lower quality (Barkin, 2011). In addition, many times those who do not pay are the ones who could afford to do so, while the lowest strata of the population tend to be the best payers (Pineda, 2011). Furthermore, as Contreras (2007) points out, improving billing or bill collection can generate inconveniences for users.

- Administration is influenced by political cycles. Although the terms of mayors and governors are considered to be a formal rule because they are specified by law, they fall into informality because these changes often lead to the replacement of the director of the organization, which is not necessarily stipulated. That is, when a political group comes to power, it seeks to place people who it trusts or controls in key positions, such as the management of the service provider entity.
- *Corruption.* This aspect can be seen from different points of view: a benefit to groups of power in bids or favoritism in the allocation of the resource without a reasonable and legal justification (Stalgren, 2006), the hiring of a number of employees to distribute power without a real need, illegal connections to distribution networks and false measurement readings that result in low billing (Elshort & O'Leary, 2005), bribes to be able to build housing when it is not technically advisable due to the scarcity of water or to get a connection or reconnection in prohibited places, not complying with penalties imposed by the authority, and in general, blatant water waste that could be the result of fraudulent activities (Kingdom, Liemberger & Marin, 2006). For González-Gómez, García-Rubio, and Guardiola (2011), the water sector is very prone to corruption due to its monopolistic structure, its technical complexity, and high demand, which gives a good deal of power to suppliers and encourages bribery.
- Imbalance. Spiller and Savedoff (1997) point out that inadequate service is a consequence of the nature of the sector, which creates incentives for inefficient behavior. Low efficiency in the operation of the agency is accompanied by low quality in the service and low willingness of the population to pay for it.

In addition to an inadequate institutional framework that does not promote efficiency, and although decentralization may have its downsides (Flores & Aguilar, 2011), two important aspects were not taken into account in Mexico in order to function properly: the municipalities are different and not all municipalities have enough resources. Regarding the first aspect, some municipalities cover over 10 000 square kilometers, while others do not exceed 100 kilometers (Urquiza, 2008). In addition, they have different geographical, demographic, cultural, and economic characteristics. For this reason, water utilities "make up a very heterogeneous group that has quite different technical, commercial, financial, and administrative competencies" (Barkin, 2011, p.545). For Flores and Aguilar (2011, p.65) "there are no recipes that guarantee that decentralization meets its objectives, ... the results may be different for each country,

moreover, they can be different for each sector of the same country or region." However, it is important to take into account demographic and cultural heterogeneity when implementing a public policy. Regarding the fact that municipalities lack resources, Barkin (2011) points out that the decentralization scheme that occurred in our country was not the most appropriate, due to the lack of technical and financial resources. In addition, the system does not promote efficiency but rather the pursuit of personal political benefits. Flores and Aguilar (2011) point out that decentralization did not ensure resources for subnational governments, it was a top-down process in which state and municipal laws had to be adapted. Although on paper it says otherwise, in practice there are gaps typical of a centralized government because agencies receive both federal and state transfers. That is, there is a strong political dependence on the definition of rates and in terms of avoiding unpopular decisions that may have electoral repercussions.

In general, the decentralization of water services for urban use in Mexico did not contemplate the poor financial capacity of most Mexican municipalities (since they depend to a large extent on federal contributions) or the existing diversity among them (Urquiza, 2008). In addition, as a result of its institutional framework, the water utilities have barriers that prevent them from improving their performance. For Guerrero (2008), these barriers can be classified as legal-political-institutional, technical-operational, and financial-commercial. Legal-political-institutional barriers hinder the professionalization of the task of managing water. Some of these barriers are the much-commented limitation in the approval of the rates, not requiring a minimum of characteristics to occupy an executive or operational position within an organization, and the lack of a norm that restricts massive dismissals of personnel after every government election. The technical-operational barriers also generate setbacks for the directors of the agencies. They have poor quality information on the exact availability of water, and in many cases, water pressure is low due to deterioration of the hydraulic network. In short, errors are corrected rather than prevented. Along with the technical barriers are financial-commercial barriers. For example, the rate is poorly designed, and fees are not charged. Organizations enter a vicious circle of losses and poor management. It is difficult, although in some cases the law allows it, to penalize those who do not pay. This generates high incompliance and increases the unpaid amounts.

As we have seen throughout this section, decentralization has been consolidated with an institutional framework that imposes barriers to good performance, and distorted incentives that contribute to the politicization of water management rather than its professional and

technical management. The decentralization of water services has entered into a management crisis because the results have not been as expected. The following section will describe how most of the water utilities in Mexico are far from meeting the objectives for which they were created.

The crisis

To speak of a crisis in the management of water for urban use in Mexico is to refer to a decentralization that did not bring the expected results. Water utilities have not performed well, in the sense of performance according to traditional notion of the extent to which an organization meets the objectives for which it was created (Georgopoulos & Tannenbaum, 1957). That is, the water utilities in Mexico have not fulfilled the objectives for which they were created, which are mainly to provide water to the population at the lowest possible costs and limit waste by being financially self-sufficient.

For Dau (2008), it is important to recognize that the water utilities in the country face the same problems they were trying to solve when the federal government handed over to the states and municipalities the responsibility for water management. This same author mentions that, with few exceptions, the agencies do not have technical or economic self-sufficiency, and that the increase in water and sewerage coverage has been achieved by government subsidies. In fact, most utilities have low levels of efficiency due to low rates and low collection, they depend on public resources for their survival (Contreras, 2007). Martínez (2006, p.61) mentions that "the lack of economic resources of the municipal governments led to redirecting the resources allocated for drinking water services to other needs, which eventually led to a de-capitalization of the hydraulic sector." If we add to this rates that are not sufficient to cover operating costs and delinquent accounts, we find financial losses that must be corrected through government subsidies.

Hugo Contreras (2007, p.92) offered a panorama, which is still valid, of what most of the water utilities in Mexico suffer: collective contracts that protect inefficient employees, managerial staff turnover with each change in municipal president, inherited debts, costs higher than income, dependence on higher-level agencies for investments, and unpaid bills. This situation feeds a vicious cycle in which there is little

efficiency in the service, insufficient collection, and therefore, lack of resources to invest, which leads to increased inefficiencies.

Among some aspects that have limited the development of the systems and that have caused the situation described above, the following stand out (Dau, 2008, Abedrop & Reyes, 2008): insufficient rates to cover operating costs; excessive turnover of managerial and technical personnel operating the organizations (according to the OECD (2013), in Mexico it is every 18 months); limited experience of the officials, because they last a short time in office and sometimes are not chosen for their technical knowledge but for political payments; excessive dependence on the state or municipal authority, since most do not have financial self-sufficiency; limited budget resources allocated to the sector; lack of training programs for technical and administrative staff; lack of incentives to achieve goals; lack of long-term planning; illegal connections, and insufficient citizen participation.

Although there is a consensus that the performance of water utilities in Mexico is poor, few studies address this issue or look for their determinants at a general level. More case studies are needed to that reflect or describe the specific situation in which the agencies are found.

In general, it can be said that the objectives for which the water utilities were created have not been fulfilled. This is evident when analyzing their management indicators. The most important information for measuring the performance of a water operator is coverage, because its main function is to supply water to the population. In Mexico, the 100% goal recommended by Tynan and Kingdom (2002) has not been met.

In addition to the coverage, in the international literature, two frequently mentioned indicators have to do with efficiency and the financial health of the organism: efficiency of the network and recovery of operating costs.

The efficiency of a network is measured through unaccounted-for water, which is the percentage of water that leaks, that is stolen, or that is consumed without payment. In Mexico, this indicator is known as physical efficiency, which is the result of subtracting the percentage of unaccounted-for water from 1 ($1 - \text{unaccounted for water}$), or dividing the invoiced water by the water produced. Both physical efficiency and unaccounted-for water are widely used indicators in performance studies of operating agencies (Ehrhardt & Janson, 2010, González-Gómez, García-Rubio, & Guardiola, 2011, Pineda & Briseño, 2012, Al-Assa'd & Sauer 2010, Schwartz 2009, Rouxel, Brofferio & Guerin-Schneider, 2008, Braadbaart, Van Eybergen & Hoffer, 2007, Anwandter & Ozuna, 2002, Alegre et al., 2000).

Recovery of operating costs (Ehrhardt & Janson, 2010, Alegre et al., 2000) is the operating income as a percentage of operating costs, it can also be measured as income minus costs. This cost recovery depends on the average rate (Ehrhardt & Janson, 2010, Gingley & Ralston, 2010, Braadbaart et al., 2007) and collection. In Mexico, the commercial efficiency indicator is used, which can be measured two ways: the water collected divided by the billed water, or the amount collected in money divided by the invoiced amount.

Given the aforementioned, there are four main indicators to measure the performance of water utilities in Mexico, according to the purpose for which they were created: coverage (supplying water to the greatest number of people), physical efficiency (with the smallest possible waste), commercial efficiency (being financially self-sufficient), and cost recovery. Table 3 shows the behavior of these four management indicators in cities larger than 50 000 inhabitants in recent years.

Table 3. Average management indicators of water utilities in Mexico.
Source: Own, with data from IMTA (2017).

Concept / year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Coverage (%)	91.8	91.3	92.3	93.1	93.5	94.3	94.5	93.6	93.6	94.2	94.0	93.7	94.2	94.2
Continuous service (%)	74.6	73.1	72.7	73.6	72.3	71.1	73.0	74.7	70.2	69.7	70.9	71.5	74.7	74.1
Physical efficiency (%)	60.7	60.9	60.2	59.3	60.1	60.7	58.5	59.9	59.0	58.7	57.4	56.5	56.6	56.2
Commercial efficiency (%)	78.3	72.2	68.6	74.9	74.4	72.9	74.2	72.8	72.3	73.2	72.7	72.3	73.2	73.0
Global efficiency (%)	46.7	44.9	41.1	44.9	44.3	45.9	45.1	45.0	44.7	44.0	44.0	43.9	43.1	41.6
Work relation (%)	102.3	108.2	103.6	106.2	109.7	109.1	111.5	109.8	107.2	111.9	109.7	112.3	120.1	121.1

Universal coverage in providing drinking water in Mexico has not been achieved. As can be seen in Table 3, the average percentage of the population receiving the resource in the country, since data have been collected, has hovered around 94 to 95%, with no upward trend. In addition, as Dau (2008) points out, if there were such an increase, it would not be due to the management of the agency, but to the granting of government subsidies. This lack of total coverage is harmful for those who have less, since they are obliged to hire water truck services, which can be more expensive (Aguilar-Benítez & Saphores, 2009).

In terms of physical efficiency, or its inverse of unaccounted-for water, the internationally recommended levels have not been achieved. González-Gómez et al. (2011) mention that the Water Leak Detection and Accounting Committee of the American Water Works Association (AWWA) (1996) recommends a water loss of 10% in developed countries, and that Tynan and Kingdom (2002) recommend less than 23% for developing countries. The estimate of these quantities in the world, according to Kingdom et al. (2006) and Sturm et al. (2008), is 15% (80% physical and 20% commercial losses) for developed countries and 35% (60% physical and 40% commercial losses) for developing countries. In Mexico, judging by the physical efficiency levels, the unaccounted-for water has hovered in recent years from 39 to almost 44% with no decreasing trend. It is not known what percentage corresponds to physical losses and what percentage to commercial.

As shown in Table 3, in Mexico there has been no substantial improvement in management indicators after decentralization was consolidated. According to the data reported in the Operative Organizations Management Indicators Program (PIGOO) page of the Mexican Institute of Water Technology (IMTA) (2017), we can conclude that coverage, which is the percentage of the population that has drinking water at home, has been one of few indicators that has improved over the years. In 2002, it was almost 92%, and in 2015 it reached 94.2%. The continuous service, which evaluates the percentage of outlets that have water at all times, has fluctuated but has remained stable, reaching a level of 74.1% in 2015. Physical efficiency (volume invoiced divided by the volume produced, in cubic meters), commercial efficiency (volume of water paid divided by the volume of water billed, in cubic meters) and overall efficiency (physical efficiency due to commercial efficiency, or volume of water billed divided by the volume of water produced) went down between the year 2002 and the year 2015, or at the very least they have remained at certain levels that do not represent an improvement. Physical efficiency has gone from 60.7% to 56.2% during the period mentioned. The work relationship, which according to IMTA (2017) measures the proportion of expenditures to income, has had an upward trend if we compare the data of 102.3% in 2002 and 121.1% in 2015.

In general, it can be observed that the water utilities do not fulfill the objectives for which they were created. They do not offer total water coverage to their citizens, they waste water because of leaks, and they are not financially self-sufficient because their rates do not cover operating costs and what is invoiced is not charged in full. It seems that "the solution to the problems of supply depends more on political and

economic issues than on the availability of the resource. An example of this is that the problems that are more quickly solved are those that arise in the big cities" (Monforte & Cantú, 2009, p.31).

It is important that the water utilities comply with their objectives. This situation is not simple, because it requires a commitment from the government, the organizations themselves, society, companies, and the media. It is necessary to raise awareness among the population about the importance of treating water as an economic good that needs to be cared for and paid for, to the media to facilitate this process, to companies to make efficient use of the resource and reuse it if possible, and at the government levels, so that they generate a more convenient and favorable legal framework that creates incentives for the professionalization of the drinking water service.

In order to improve the conditions in which utilities operate, it is necessary to promote some lines of action that represent interesting challenges for water stakeholders. Some of these challenges are the following (Buenfil and Donath, 2008): financial autonomy, formalize suspension of service to users with delinquent payments, clear methods and formal reviews of fee structures, continuity of officials and plans beyond political terms, personnel certification, information transparency, better practices, routine and mandatory training, no overexploitation of aquifers, organization manuals, continuity of competent officials, accountability of those who leave office, and incentives for staff.

There are many lines of action that can be undertaken to improve the circumstances and the environment of the operating agencies. In the end, it is the institutional arrangement, or the "rules of the game," (North, 1993, p.13) that will determine to a large extent the performance of these service providers. That is why an institutional design is required that encourages them to carry out the objectives for which they were created.

Contreras (2007) mentions that there must be entities whose responsibility is to monitor that the water utilities provide an adequate service, and avoid having town councils and congresses make decisions about the rate and other issues that may generate political costs. Urquiza (2008) suggests that it is better that the provision of the service be carried out by a regional, rather than municipal, organization that has greater financial capacity and long-term planning. The municipality depends on managerial changes, and the duration of strategic projects that last longer than three-year mayoral terms.

In general, we are facing an incentive problem. There are incentives for the operator to have poor results due to political costs and corruption. In addition, the population does not receive incentives to conserve water

or to pay it in a timely manner. It is necessary to review the current institutional framework and adapt it so that the water utilities in Mexico are efficient, socially responsible, and financially self-sufficient companies.

Conclusions

As we have seen throughout this article, water management has moved from the municipal sphere to the federal sphere, and then to a process of decentralization begun in the 1980s, and is now in crisis. The problems that led to the municipalization of drinking water services continue: financial insufficiency to cover operating costs and inefficiency in the service. It could be concluded that municipalization and decentralization have not been successful because there has been no financial or operational improvement.

Water utilities were created as a result of the decentralization process, in order to provide a service that was professionalized, with rates determined in a technical manner, increased collection to be invested in infrastructure, administrative autonomy to be able to carry out the appropriate works, and management to provide a better service to the population. However, the current reality shows us that the water utilities have not fulfilled the functions for which they have been created, namely, to provide water to the population at the lowest possible costs and minimal waste. Currently, in the vast majority of these, the rate is insufficient to cover operating costs, there is a high turnover of personnel linked to political periods that reduce the capacity for long-term planning, the water provided to users is not billed or collected, and there is a large quantity of water lost due to leaks in the distribution networks. There are projects to provide water to cities that do not have full coverage. However, they are not always accompanied by an improvement in the efficiency of the water utilities.

Based on what is presented in this article, the low performance of water utilities in Mexico could be attributed to two main causes: they act on a logic of seeking political - electoral gain, and therefore, do not charge for services in time and form, and municipal agencies do not have sufficient resources to carry out the responsibilities for which they were created. It is urgent to depoliticize water services due to the persistent shortage in several points of our country. According to the Atlas of

Water in Mexico published by the CONAGUA (2016), the states that are overexploiting aquifers are the following: Aguascalientes, Baja California, Baja California Sur, Coahuila, Chihuahua, Mexico City, Durango, Guanajuato, Jalisco, Mexico, Michoacán, Nuevo León, Puebla, Querétaro, San Luis Potosí, Sonora, and Zacatecas.

It is necessary to professionalize the operating organizations, and the decisions made must not be influenced by political terms or interests. To this end, it is important that the rate not be determined by local councils and congresses. Those who can pay more should, so that the neediest can contribute according to their abilities. Services should be suspended for users with delinquent payments, and no exemptions should be given for public entities. Only by generating mechanisms that depoliticize water management can the service be carried out more efficiently. More knowledge about water scarcity in various parts of the country is also needed, in order to raise awareness among the political class and society about the importance of good resource management. This means charging fees appropriate to the costs, rehabilitating water distribution networks to avoid wasting the resource, and achieving full coverage.

It is useful to have autonomous institutions made up of experts from society, which regulate the water utilities in such a way as to prioritize technical over political criteria when making important decisions about water management for urban use.

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