Chapter 7
Prices and Water: A Strategy with Limited Effectiveness

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Abstract This paper studies the characteristics of water markets in Mexico under the analysis of water and food security. Water management functions are related to the mechanisms of water allocation for the different areas of use: food production, environmental services preservation, social welfare promotion by ensuring direct water consumption to citizens, and economic prosperity by its productive use. Regular and stable water supply of sufficient quality, wastewater collection and treatment, and billing and collection of water consumption correspond to the Operating Organizations of Drinking Water, Sewage and Drainage. Water is a good with no substitutes, it is transversal and it constitutes a natural monopoly. The phenomenon of institutional evolution which results in a scenario of water resources management system fragility, characterized by the lack of coordination between different management levels related to water policy, is analyzed in the first part of this chapter. The phenomenon of financial sustainability required for water and food security promotion is discussed in the second part.

Keywords Water · Prices · Markets

7.1 Introduction

It is considered appropriate to establish a set of elements to clarify the meaning of the 'market' and 'price' terms utilized in this text to study the characteristics of water markets in Mexico under the analysis of water and food security.

As stated by Van der Zaag/Savenije (2006), there is confusion in the analyses that compare the functions of the entities responsible for the provision of drinking water, sewerage and drainage services, with those concerning to institutional functions related to the water management model. In this regard, it is worth noting that the functions of water management are related to the mechanisms of water allocation for the different areas of use: food production, environmental services preservation, social welfare promotion by ensuring direct water consumption to citizens and economic prosperity by using it in the productive sectors. The functions that correspond to the Operating Organizations of Drinking Water, Sewage and Drainage

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(OOAPAS in Spanish), which are responsible for the provision of public services at local level, are regular and stable water supply of sufficient quality, wastewater collection and treatment, as well as the billing and collection of water consumption.

Something similar happens to water markets and prices. Markets often refer transaction structures for private goods, i.e., goods that possess the attributes of exclusivity and rivalry, as defined in economic theory. Extending this definition to the case of water, without the corresponding clarification, would lead to misinterpretation considering water as a private good and its social allocation process would proceed through pricing arrangements. In the case of the latter category, economic theory conventionally states that prices are the expression of the exchange value of the goods that are object of the transaction, and its formation takes place based on production costs structure and acceptable profit margins for producers. However, prices, beyond their formation, can be interpreted as carriers of information about the intrinsic difficulty for the production of goods or their availability, thereby facilitating individual allocation mechanisms.

This allows to establish the meaning of the concepts of 'markets' and 'prices' used in this document. 'Markets' refer to the set of social spaces for interaction and exchange bounded by rules and social, cultural, historical, and legal values, and that may include not only private but also public goods (those without some or none of the characteristics of private goods). 'Prices' refer to vehicles of information and mechanisms to facilitate the assignment, whose magnitude may include, not only reference to costs, but also elements related to some sort of institutional intervention in terms of constraints that inhibit adverse effects in the collective welfare. In the latter case and to avoid confusion, hereafter the author refers to water rates to highlight that this element is not just a simple good for economy or for a commodity, but one for which there are no substitutes, it is transversal and it constitutes a natural monopoly.

The characterization of water markets in Mexico and the current tariff structure are analyzed from the perspective of the possibility of institutional competencies accumulation that facilitate a transition that strengthens the management model from the perspective of water and food security.

The study is divided in two sections. In the first one, the institutional evolution that has resulted in a scenario of water resources management system fragility, whose most significant feature is the lack of coordination between different management levels related to water policy, is discussed. The second part refers to the financial sustainability required for water and food security promotion.

7.1.1 Contemporary Water Markets in Mexico: Their Institutional Origin

The current situation of the Mexican water sector is the result of a historical, institutional, and cultural evolution that has facilitated the consolidation of contemporary careless practices of use and procurement.

Collado (2008) carried out a reconstruction of how the institutional water treatment has historically evolved in Mexico, from a perspective where several significant facts stand out. First, the tradition of water use and its management as a common good related to local practices begins to fracture in the late nineteenth century. Second, the federalization of water management is associated, at the time, with the possibility of granting concessions (Aboites 2004). Third, the emergence of a definitive water management system that recognizes the existence of national waters and favors the figure of the federation in this matter, comes from the enactment of the Water Use Act of Federal Jurisdiction (1910), the Constitution (1917) and the Law on Irrigation with Federal Waters (1926).

Water legal changes have been successive and periodic (Dau 2008), and have required, in turn, changes in the management structure. However, water was interpreted at the time as a promotional vehicle. The corresponding laws, from the late 1920s to mid-1940, empowered the Ministry of Agriculture and Development (SAF in Spanish) to attend the authorization of projects and uses of water.

Population growth rate in the country, particularly in urban areas, and economic growth process supported federal participation functions in the Local Boards of Water Users, to change from a passive role to another of increasing directionality, as the investment funds required for the development of infrastructure for water supply, could only be authorized by federal representatives (Pineda 2008).

The SAF was restructured in 1946, leading to the creation of two new entities, the Ministry of Agriculture and Livestock (SAG in Spanish), responsible for water in irrigation districts, and the Ministry of Water Resources (SRH in Spanish), responsible for planning, monitoring, implementation of the drinking water and sanitation projects, when such infrastructure was financed with federal funds. In this case, the federal agencies remained at local level until the amounts invested were recovered and they were responsible for the operation of drinking water supply (Collins 2008).

With the Cooperation Law for Drinking Water Allocation to Municipalities (1956), the federal government agreed to finance part of the works needed without requiring fund recovery as long as the population accepted the quotas fixed by the federal authority, previous relevant socioeconomic studies. Two facts stand out in this evolutionary process of water policy of Mexico. On the one hand, the gradual and paradoxical centralization at federal level, of the functions associated with the growth promotion of agricultural production from the control of water for irrigation, and the growing interference in the provision of drinking water and sewerage services, given the implicit renunciation of local authorities to exercise their powers. On the other hand, it is observed the emergence of the fee dispersion and its lack of updating, as a phenomenon that decades later would become a powerful reason to promote the decentralization of functions in local drinking water supply and return them to municipalities.

Water institutional process continued on a path that consolidated the presence of federal authorities at local level, which is confirmed by the creation of the Ministry of Human Settlements and Public Works (SAHOP in Spanish), whose duties consisted of infrastructure construction and its operation. In 1980, it was tried to

reverse the tendency towards centralization of functions in drinking water and the provision of related services, by presidential decree that returned to the states and municipalities such obligations. However, this first attempt was not successful; federal water responsibilities continued to be part of institutional functions of the SAG, the SRH and, later, the Ministry of Urban Development and Ecology (Sedue in Spanish).

It is not until 1983, with the amendment of Article 115 of the Constitution, that a process of decentralization of drinking water and sewage begins, which was institutionally strengthened with the creation of the National Water Commission (Conagua in Spanish) in 1989 and the creation of the Operating Organizations of Drinking Water, Sewage and Drainage (OOAPAS) in the early 1990s (Soares 2007).

Water policy transition in Mexico has two essential aspects to put contemporary functioning of water markets in the country into perspective. On the one hand, the fact that with the process of centralization of functions in water, a loss of local technical capacities for the implementation of a strategy for efficient water resources use was sponsored. On the other hand, a public culture was promoted, which considered that federal authority presence was essential and indispensable in the process of providing drinking water services to localities, and a context that assumed that market access had low cost, derived from the lags in updating consumption rates.

The fragility of public finances from the 1980s, increasing costs of the operation model of water policy, and a better understanding of the ecosystem implications of water use, provide the scenario in which the decentralization of operations and economic, fiscal, and financial instruments are the axes that articulate the contemporary water strategy.

By considering water markets as spaces of interaction based on water volume transactions, a way to set the different areas covered by that name is the one originated from the classification of the Public Registry of Water Duties (REPDA in Spanish). This institutional arrangement is essential in the design of water management mechanisms, as its update, from the 1990s, allows to incorporate at the same time different dimensions of the water management issues, not only in terms of demanded volumes, but also the resilience and pressure on water resources and, of course, the financial aspects.

In the process of water management evolution, which involves the issuance of grants, allocations and permits from the federal authority to attend multiple purposes such as drinking water supply (through OOAPAS), productive use in food production, industrial activities, power generation, and other uses, such as recreational and environmental, it gradually accumulated an information lag on rights and utilization volumes. The REPDA organizes information of water exploitation permits and it sets limits to applicants; these authorizations can be assigned to individuals or entities, according to aquifer availability and the intended water use (Garduño 2003).

Water supply required for various uses can occur in various ways. In the case of productive uses and energy production, they can be accomplished by direct exploitation by production or consumption units, up to the limits set by the

corresponding authorizations. In the case of massive drinking water supply in urban areas, usually the authorization is conducted through the OOAPAS or private water services companies, if available at local level, although it can be requested authorization to directly exploit federal waters. All uses and sources, including sewage discharge, have a record in the Public Registry of Water Duties.

The REPDA provides an adequate approximation to the characteristics of water transactions for different uses and it puts into perspective the financial aspects of the water management structure in the country. However, REPDA ascertains information of authorized volumes and not of the actually used, which may be greater than those authorized, subject to penalties or cancelation of the operation, or below the set limits. These differences have created a market to buy and sell rights, prior approval of water authorities.

7.2 Contemporary Water Markets in Mexico and Some of Their Main Features

Water markets are defined herein as the area of interaction of water supply and demand for generic uses considered by REPDA. Such regulated and monopolistic markets have the particularity that the supply is limited by the amount of the corresponding authorizations according to its use and sources availability. The volume of records currently valid in the REPDA exceeds 450,000 and, in volumetric terms, it implies an allocation of approximately 88 % of surface water and 12 % of groundwater in the country (Conagua 2011a).

Table 7.1 puts into perspective the existence of different water transaction areas; the General Regime item, integrated by extractive consumption done by industry, draws attention.

As it can be seen, water markets can be segmented into three groups: water for production, water for people, and water for energy; of course, a set of specific activities is associated with such categories.

The amount of duties that are assigned to the uses is determined based on the characteristics of availability segmented in nine zones, in the declared uses, and authorized levels in each concession.

It is important to distinguish between water policy objectives and achieving objectives by drinking water policy performers, especially in urban centers. However, it is necessary to order a little the problem of tariffs. Perhaps because of the way the Mexican institutional design has evolved over time, one may have the impression that the main problem of the national water policy is to achieve financial strengthening of the drinking water supply systems in human settlements, as a central factor to reduce pressure on water resources. However, due to consumption distribution and its influence on water resources, increasing the magnitude of the payments made by domestic water consumers—important and relevant matter—it does not seem to be the issue that solves by itself, the problem of supply system sustainability or pressure on water stocks.

Table 7.1 Duties for the use of national waters, according to availability zone, 2010 (cents per cubic meter)

Use	Zone								
	1	2	3	4	5	6	7	8	9
General regime	1828.94	1463.1	1219.24	1005.89	792.48	716.23	539.09	191.53	143.54
Drinking water, consumption more than 300 l/inhabitant/day	72.46	72.46	72.46	72.46	72.46	72.46	33.74	16.85	8.39
Drinking water, consumption equal to or less than 300 l/inhabitant/day	36.23	36.23	36.23	36.23	36.23	36.23	16.87	8.43	4.19
Agricultural, without exceeding the assigned volume	0	0	0	0	0	0	0	0	0
Agricultural, for every m^3 that exceeds the assigned volume	12.95	12.95	12.95	12.95	12.95	12.95	12.95	12.95	12.95
Spas and recreational centers	1.04	1.04	1.04	1.04	1.04	1.04	0.51	0.24	0.11
Hydropower generation	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38
Aquaculture	0.3	0.3	0.3	0.3	0.3	0.3	0.15	0.07	0.03

Source Conagua, Statistics on water in Mexico, 2011 edition

National water strategy, in an environmental context as proposed by the General Law of Ecological Equilibrium and Environmental Protection (LGEEPA in Spanish), has as main objectives to ensure citizen welfare, to encourage economic prosperity and to promote its preservation (SEMARNAT 2008). To encourage water allocation processes in such large set of goals is not a matter of relative prices. Economic instruments available for its implementation are of three types: fiscal, financial, and market. The first type concentrates on the amounts and collection of rights. The second type, depending on water use, in the securities system and liability insurance and third type, in the operation of a market of rights transfer.

However, from the aforementioned instruments, the one that affects the operational capacity of water policy is the payment of rights. In this regard, it stands out that the primary sector, which has the major direct water consumption in the country, generates an inversely proportional contribution on rights payments (Table 7.2). This, although subject to controversy from a water perspective, is not different from the experience in other countries. When considering a transversality approach, as is done in the water footprint analysis and it is explained throughout this study, we realize that water content used directly in the manufacture of products does not necessarily reflect the importance that this good has as production input. The use of indicators of direct use prevents to quantify the water volumes that are actually utilized in the manufacture of consumption goods and the possible existence of an underlying cross-subsidies mechanism (Table 7.3).

In a scenario that only considers the direct consumption of water users, it might seem that the essential problem is the use efficiency in the primary sector. This is appropriate if sectoral linkages are not considered, but also heterogeneity in the productive capacities of the federal states (Fig. 7.1).

It is possible that because drinking water supply and the intrinsic value that it may have for the consolidation of an initiative of decentralization of functions in this area are important for local governments, there is a greater coverage about budget shortfalls faced by national water sector in relation to drinking water, sewerage and sanitation subsector (APALS in Spanish). And while it is certainly an important component of federal budgetary disbursements, it does not seem to correspond to, in volume terms, the magnitude of national consumption for domestic purposes, with the importance acquired by the financing derived from the collection of domestic rates.

The growing and repeated emphasis on national dispersion of tariffs for domestic uses, the relative opacity in the criteria for establishing levels in local areas, and heterogeneous coefficients of collection efficiency at local level, are matters of water agenda that have contributed to create a relative confusion in public opinion.

It is true that OOAPAS must maintain a financial position to strengthen its capacity to modernize its infrastructure, expand coverage, maintain and ensure supply quality, this must be done based on consumption payments. But one cannot forget that this type of consumption is only part of the volume of total domestic waters and also, once the flows to be used by local supply systems are authorized, there are several uses: residential, commercial, and industrial.

Table 7.2 Collection of CONAGUA of duties by concept, 2000–2009 (millions of pesos at constant 2009 prices)

Concept	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Use of national waters	7343.80	7122.30	7645.80	8231.50	7796.50	7814.40	7386.80	7875.10	8003.70	7938.50
Bulk water supply to urban and industrial centers	1311.70	1332.90	1292.80	1473.90	1383.90	1634.60	1516.40	1601.50	2148.50	2074.70
Irrigation services	168	192.5	193.3	176.2	179.6	184.3	176.4	210.2	204.8	225.7
Material extraction	46.4	50.1	38.8	34.9	44.3	40.7	60.1	40.1	44.9	45.7
Use of receiving bodies	51.1	91.2	71	82.1	80.8	61.4	55.7	63.4	61.2	179.4
Use of federal zones	29.3	28.4	28.3	30.2	38.6	32.5	30.6	38	33	38.2
Various	330.4	275.6	267.6	133	89.8	89.9	134.1	103.8	348.6	213.9
Total	9280.70	9093.00	9537.60	10161.80	9613.50	9857.80	9360.10	9932.10	10844.70	10716.10

Source Conagua, Statistics on water in Mexico (2011c:87)

Table 7.3 Volumes and surfaces allocated by type of use and exploitation at December 31, 2010

Use	National waters				Water discharges		Federal zones		Material extraction	
	Titles	Extraction volume m^3/year			Sewage					
		Surface water	Groundwater	Total	Titles	Discharge vol. m^3/year	Titles	Surface in m^2	Titles	Volume
Agricultural	145,113	36,049,022,148	17,708,607,516	53,757,629,664	325	6,899,354	60,080	1,257,544 652	4	33,208
Agroindustrial	66	464,920	5,134,357	5,599,277	18	630,360	5	153,471		
Household	15,462	13,652,848	25,809,992	39,462,840	77	2,360,219	1,404	697,898		
Aquaculture	876	1,035,474,699	18,083,070	1,053,557,769	370	3,898,126,148	234	4,969,584	1	1,095
Services	5,616	492,361,927	746,169,024	1,238,530,951	6,246	942,141,089	6,221	43,255,878	1,379	72,483,865
Industrial	4,897	4,322,463,210	1,428,620,946	5,751,084,156	2,295	10,184,638,775	492	10,330,153	108	7,670,910
Livestock	35,780	63,536,621	127,310,243	190,846,864	1,113	18,582,363	9,787	534,710,056		
Urban public	120,851	4,266,958,691	7,084,807,514	11,351,766,205	3,120	3,395,041,432	18,015	3,489,784	2	2,000
Multiple	38,065	2,246,543,448	2,333,099,495	4,579,642,943	870	4,484,404,359	4,234	312,054,232	245	36,181,694
Power generation	103	165,066,111,646	778,857	165,066,890,503	0	0	23	539,465		
Trade	2	0	80,000	80,000	0	0	102	28,882	1,381	43,153,346
Others	5	300 000	241,416	541,416	0	0	270	775,228	34	80,953
Total	366,836	213,556,890,159	29,478,742,430	243,035,632,589	14,434	22,932,824,099	100,867	2,168,549,283	3,154	159,607,071

Source Conagua, Statistical compendium of water management (CEAA in Spanish) (2011a:41)

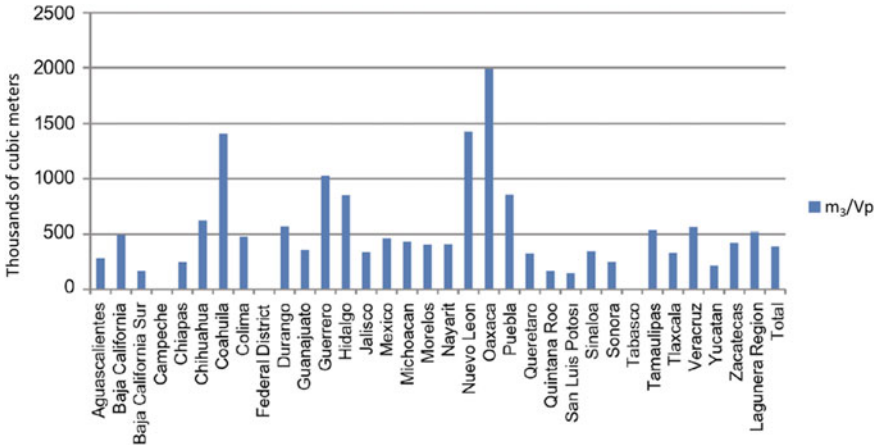

Fig. 7.1 Water volume per million of agricultural production value (Cycle 2008–09). *Source* ConaguaA (2009), Agricultural statistics of irrigation districts, Mexico

It should be emphasized that the sustainability of urban water systems is important, but it is related to the local supply security and not with the way water uses are socially assigned at federal level. The financial health of OOAPAS depends not only on the amount and magnitude of their income, but also on their cost structure. These are determined, greatly, by the technological choices of the way at federal level, water use is established and encouraged. And it compromises water security.

Sectoral investments in water supply in urban areas tend to increase (Fig. 7.2). In part, this is due to the delays accumulated in this area over time, but they are also associated with increased costs of water provision in a context of overexploitation of watersheds and an operation model with increased energy costs (Fig. 7.3).

Drinking water financing rests predominantly on the federal level, but the co-responsibility of the state and municipal governments related to contribution is tending to increase (Fig. 7.4).

Meanwhile, although a significant difference remains between billing and collection of water, sewerage and sanitation services at national level (Fig. 7.5), it does not explain the eventual financial fragility of the national water sector as a whole, but the one related to urban water supply.

Sustainability of urban drinking water supply services is not a minor issue; it is necessary that users have a reference of direct costs, but also of the intangible costs such as the supply difficulty costs and those related to ecosystemic aspects. Bills should include not only aspects of production or distribution but also those related to treatment.

For a signal strategy via relative prices to be effective in moderating consumption patterns and incorporating innovative practices to increase utilization efficiency, it must rest on transparency and agent knowledge about potential hidden

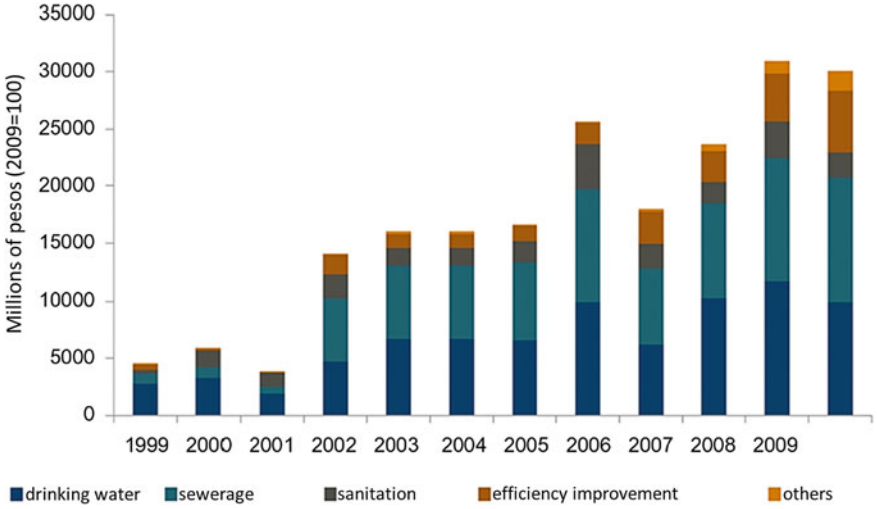

Fig. 7.2 Subsector total investments: including programs of Conagua, SEDESOL and Banobras. *Source* Data from Conagua/SGAPDS/Management of Studies and Projects of Drinking Water and Sewerage Network

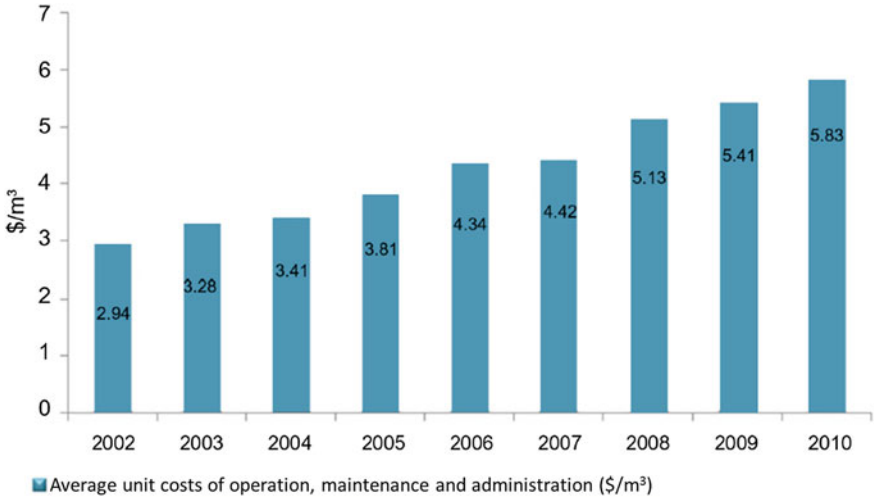

Fig. 7.3 Average unit costs of operation, maintenance, and administration OOAPAS *Source* Data from IMTA (2010), Program of Management Indicators of Operating Organizations of the Mexican Institute of Water Technology, SEMARNAT

water use subsidies. There is not enough evidence to infer that any volumetric savings that could be achieved via household consumption would compensate for the lack of incentives for water conservation in the productive sector performance.

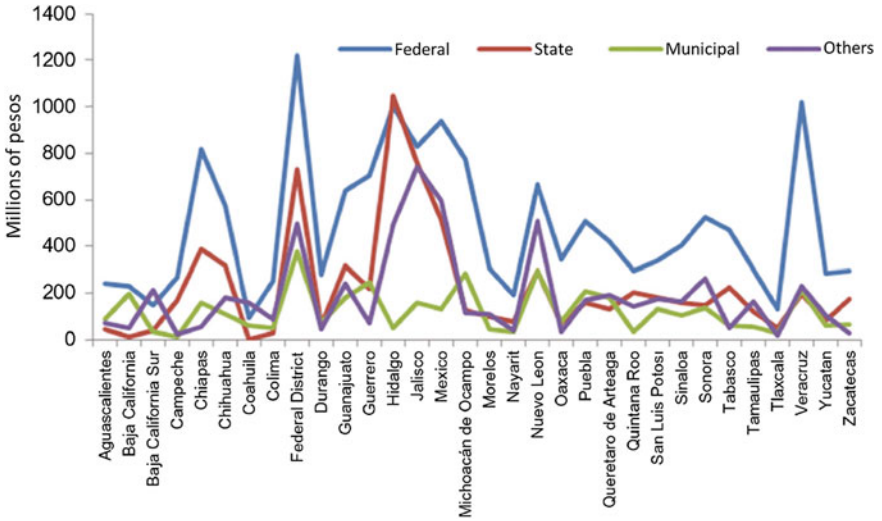

Fig. 7.4 Investments reported by federal states by resource origin sector 2011. *Source* Data from Conagua (2012), Situation of Subsector of Drinking Water, Sewerage and Sanitation

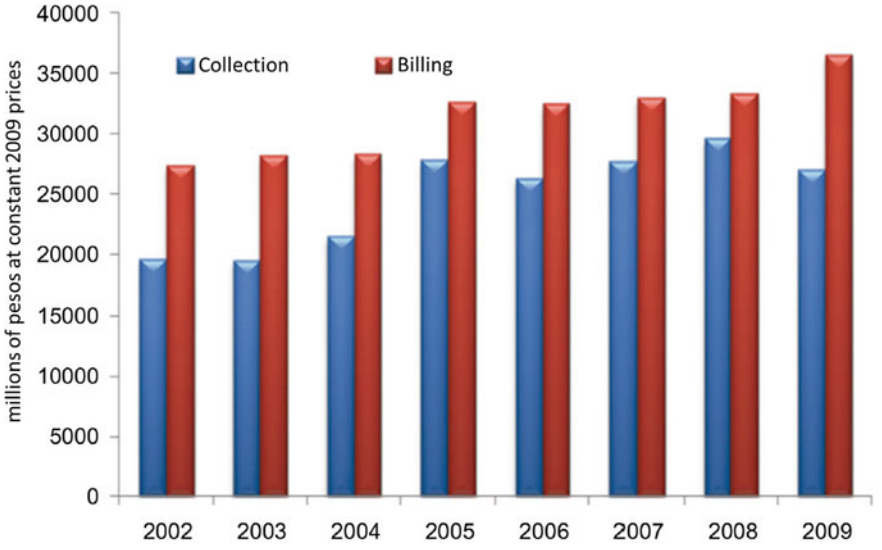

Fig. 7.5 Annual billing and collection of operating organizations. *Source* data from Conagua (2011b). Instruments for water management in Mexico

At the same time that investments in drinking water supply for public consumption has increased, it has also increased the amount of irrigation infrastructure in the country (Fig. 7.6).

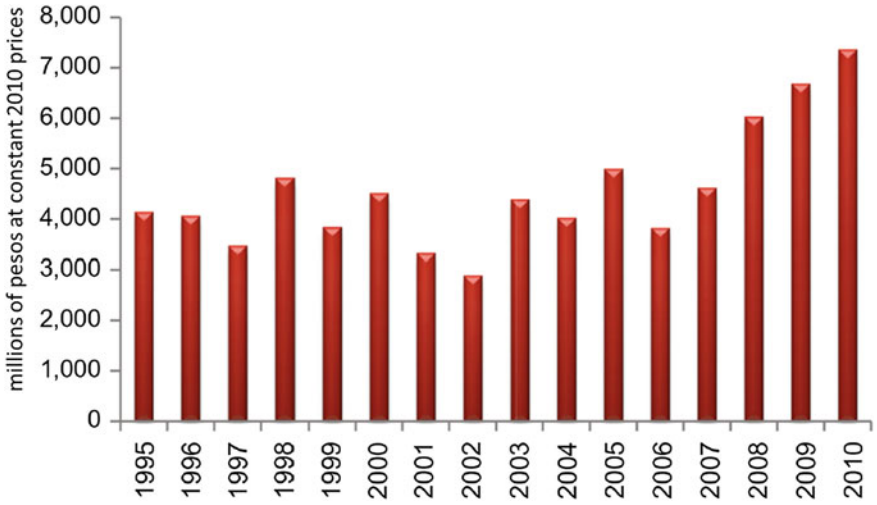

Fig. 7.6 Public investment in hydro-agricultural infrastructure. *Source* data from Statistical Annex of the fifth government report (2011)

The above statement should not be misunderstood; it is necessary for the economy as a whole to reduce the pressure on water resources and to promote use practices to be sustainable, from water, ecosystemic, and financial perspectives. Of course, it is desirable that it happens in all sectors.

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