DOMESTIC WATER ACCESS AND PERIURBAN POVERTY IN THE METROPOLITAN ZONE OF MEXICO CITY: LESSONS TO IMPROVE POLICY DECISIONS?

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Abstract

This paper directly engages the question: "how can domestic water access be explained when it depends not only on public provision schemes but also on a variety of adjustment mechanisms in order to properly fulfill the needs of the periurban poor?" Using two case studies from México, this piece highlights differences in public-private arrangements for water access in order to contribute to a better understanding of particular processes that give poor populations access to water in a city's periphery.

The main objective is to explain how domestic water access processes have changed in two of the poorest periurban settlements of the Metropolitan Zone Of Mexico City (hereafter, MZMC). The selected cases are: San Isidro Tlaixco, Chimalhuacán and Santiago Tepatlaxco, both located in Mexico State (hereafter, Edomex). Based on the comparison of empirical data collected in the years 2010 and 2016, this study reveals valuable information related to two main aspects: (1) changes in water access conditions at domestic and community level; and (2) the dynamics of social adjustment strategies, developed by dwellers in both areas, to deal with the lack of water and sanitation in their homes.

Introduction

High population densities in large cities impose different challenges on governments and society. Issues like water shortages—along with other related troubles, such as the lack of suitable land for urban development, poverty increase, deficiencies in public services, or the need for effective environmental management schemes—are some of the most complex matters with which urban governments and denizens have to grapple. As one of the oldest and largest population centers in the world, the MZMC is a living laboratory for all of the above-mentioned tribulations.

The topic addressed in this work results from the combination of two main problems. The first problem has to do with the actual water management model in the MZMC. The second one is related to the rapid transformation of peripheral spaces in the metropolis. As a result, periurban settlements surrounding the city are characterized by rapid growth in public water demands.

Peripheral transformation of the MZMC

The MZMC is one of the most populated urban centers in the world[1]. It contains 76 government entities. Sixteen entities (called *delegaciones*) correspond to Mexico City (CDMX) and sixty municipalities correspond to Mexico and Hidalgo states. The

[1] Source: Cities of the world. http://www.nationsonline.org/oneworld/bigcities.htm

Mexican National Population Council (Conapo, in its Spanish acronym) estimates that by 2030, the MZMC's population size will reach 22, 359, 649 inhabitants. The central CDMX will remain without changes, but the peripheral areas of Mexico and Hidalgo states will grow until they reach almost fourteen million inhabitants.
Population growth projections suggest that the urban periphery of the MZMC will therefore continue to exert pressure on resources. This process is somehow encouraged by local urban policies, supporting an expansive and dispersed pattern of growth. In spite of such sprawling development, periurban areas have received little attention in urban planning efforts. These spaces are critical areas in terms of land use changes. For instance, periurban areas typically face high demands for housing from all kinds of social actors, including the poorest groups in the city (Aguilar & Escamilla, 2011; Escamilla & Santos, 2012).

The water management model

Water management in the MZMC can be described as following an extractive model. Its main characteristics are the importation of water from other basins (or extracted from fossil aquifers) and the growth of piping networks for the distribution of water. This model has been regarded by relevant academics and NGO's not only as inefficient, but also inequitable and wasteful. These characteristics make water management schemes ecologically unsustainable and highly vulnerable (Graizbord & Sotelo, 2012; Perló & González, 2005).
As a result, the MZMC possess the highest levels of infrastructure for water distribution and sewage systems in the country. Nevertheless, unequal conditions of water access prevail among its inhabitants. Differences in water access level across the metropolis contribute directly to increasing social inequality problems. Average water consumption quantity in Mexico City has been estimated at around 314 liters per capita per day (lpcd). However, it seems that more than 70% of the population in the MZMC consumes less than 150 lpcd. These differences have a clear spatial expression. It is estimated that people living in Tlahuac and Milpa Alta[2] or Valle de Chalco, Chimalhuacán and Jilotzingo[3] have less water available than people living in *delegaciones* Magdalena Contreras or Cuajimalpa (Ortega, 2010; González & Ziccardi, 2011).

Peripheral transformation and water access conditions

The National Urban Development Program 2014-2018 points out that the predominant Mexican model of metropolitan growth encourages extended, dense, and peripheral cities. This model increases government expenditure because the cost of public provision of water services tends to increase with distance. Therefore, decreasing quality and public capacity to properly allocate water is an expected consequence of the urban sprawl model (DOF, 2014: 5).
Since the motivations for allocating water services are not always the same for producers (local governments) and consumers (inhabitants), nor necessarily is

[2] The *delegaciones* conform the local government inside Mexico City, much like a borough.
[3] Municipalities are the local government level within federal states.

convenience for the latter paramount to the former, it is expected that, when urban systems expands, inequalities in the availability and accessibility of water services will also increase. Most of the times, these inequalities act in detriment of poor people's living conditions, settled in periurban spaces (Tiebout, 1955; Harvey, 1996; Graizbord & Acuña, 2006).

In terms of satisfying human need, adequacy of water access in periurban areas depends not only on the availability of public infrastructure for water provision, but also on the articulation of many types of resources on the inhabitants part, including money, time, labor, and social organization. Such an articulation implies potential impacts on the living conditions of families in terms of income level, time availability, and health. In these circumstances, domestic water access depends on small-scale direct sale systems or communitarian water allocation arrangements. For instance, private water vendors often operate in unregulated and informal markets, with disproportionately high unitary prices. Despite this, the low *per capita* level of water consumption appears to be common place in these areas (Aguilar, 2008; Aguilar & López, 2009; Allen et al, 2006; Allen et al, 2006b; Bartlett, 2003; Gómez-Valdez & Palerm-Viqueira, 2015; Tortajada, 2008; Varis, 2006).

Methods and materials

In order to explain domestic water access in periurban settlements within the MZMC, two case studies were selected. Inhabitants in both cases are mostly poor. The cases are located in the external ring of the metropolis. The first case selected is San Isidro- Tlaixco, in the municipality of Chimalhuacán, Edomex. The second case selected is Santiago Tepatlaxco, in the municipality of Naucalpan, Edomex (Figure 1).

This work's approach to cases studies started with statistical demographic and development data review from 2000 (the year when both cases were incorporated to the official delimitation of the MZMC) to 2010. In order to observe changes and perhaps some tendencies in social arrangements to deal with water scarcity, the statistical review was complemented with semi-structured key informant interviews and fieldwork observations carried out in two different years: 2010 as and 2016.

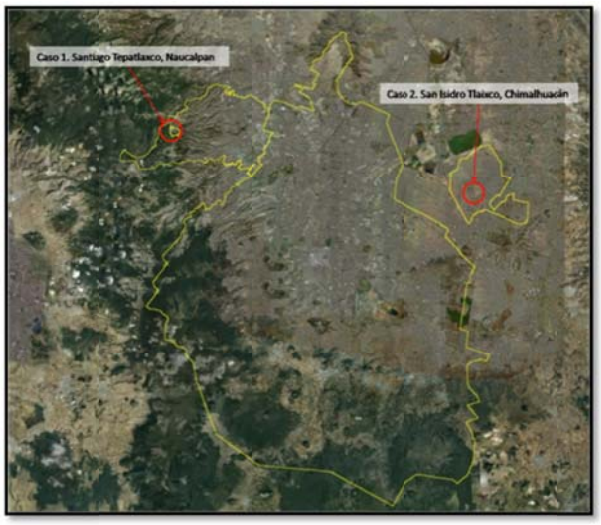

Figure 1. The MZMC and case studies location

The conceptual model

The analysis was made following the "water supply wheel" model, proposed by Allen, Dávila, and Hoffman (2006). The model "[…] outlines a continuous spectrum of policy and needs-driven practices characteristic of water provision in the peri-urban interface". The left side of the wheel (*policy driven*) can be identified from the perspective of production and provision, and it includes those practices with some degree of formality. The right side of the wheel shows the arrangements closer to the perspective of access and, in particular, "[…] from the viewpoint of highly localized strategies adopted by the peri-urban poor" (2006: 339-340) (Figure 2).
From all alternative combinations observed in the wheel, three kinds of actors can be seen: public actors, private actors, and social actors. In this work it is assumed that local government agencies (as providers or regulators) are the public actors involved. Individual or collective water vendors represent private actors. Private actors could be formal or informal. Social actors include households and dwellers, but also social or political organizations somehow involved in the water access process. Depending on the role assumed by each actor (provider, regulator, mediator, or consumer) different modes of interaction can be possible.

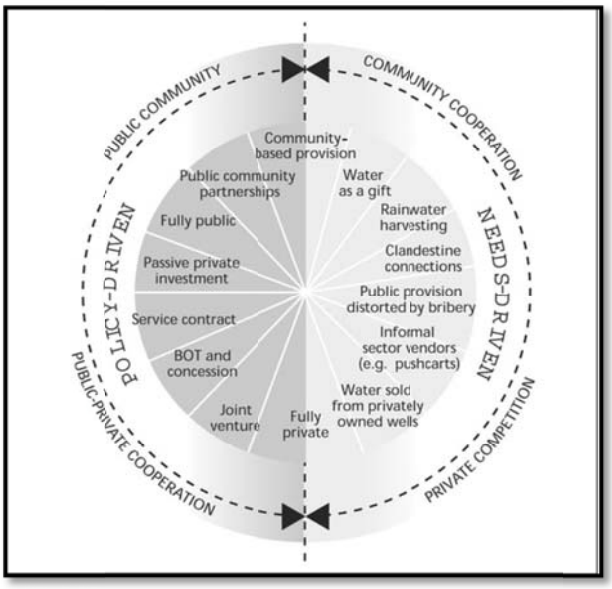

Figure 2. Policy-driven and needs-driven practices in the "water supply wheel" (Allen et. al., 2006)

Results and discussion

The comparison between the case studies starts off with the assumption that there is not a unique mechanism by which periurban dwellers gain access to water (and sanitation). Given the inefficiencies and inequalities in public provision systems, domestic water access relies on the articulation of different types of strategies, which combine a wide range of actors and resources.

The statistical data show that both case studies had experienced two growing tendencies in recent years. The first one is a constant growth in the number of housing units in both settlements. In 2010, the number of housing units in San Isidro Tlaixco totaled 683, which increased by 223 units (50 percent) from 447 in the year 2000. Santiago Tepatlaxco had experienced a similar tendency. Over one decade, total housing units in this settlement grew by almost 40 percent, increasing from 634 housing units in 2000, to 861 in 2010 (Figure 3).

WATER ACCESS CONDITIONS						
YEAR	2000		2005		2010	
CASES	SAN ISIDRO TLAIXCO	SANTIAGO TEPATLAXCO	SAN ISIDRO TLAIXCO	SANTIAGO TEPATLAXCO	SAN ISIDRO TLAIXCO	SANTIAGO TEPATLAXCO
HOUSING UNITS	447	634	569	629	683	861
PUBLIC PIPES AVAILABLE, WATER INSIDE HOUSE	0.22%	9.31%	0.35%	79.65%	94%	97%
PUBLIC PIPES AVAILABLE, WATER OUTSIDE HOUSE	1.34%	81.70%	47%	18%		

Figure 3. Housing units and water access conditions in case studies
Source: Own elaboration based on data from INEGI, 2000; 2005 and 2010.

The second notable trend is the increase of housing units connected to public water pipes, which could be an indicator of public investment increase for water infrastructure. In spite of this tendency, field observations in both locations have shown that, rather than improve water and sanitation access, this growing tendency has emphasized the differences in living conditions within and between both settlements. In San Isidro Tlaixco, the intermittent delivery of piped water, combined with a short water storage capacity in housing units, provoke water stress for households. In this situation, dwellers have to deal with informal water vendors, paying a high portion of their household income to fulfill basic water requirements. In Santiago Tepatlaxco, there is no proper distribution system. Since this is an irregular settlement, water access depends on the community organizing around the management of a precarious, self-constructed, and intermittent water distribution system.

Given the high cost of water (monetary and non-monetary), people in both cases have developed different adaptation strategies. Some of these imply social exchanges, based on solidarity and communal work. Other strategies involve the articulation between market and government. As a result, accessing water in these settlements has become a much more complex process than the one that a massive public provision system tends to assume.

Needs-driven and policy-driven mechanisms in San Isidro Tlaixco

In 2010, the water access process in San Isidro was characterized by insufficient water supply and inadequate sanitation. In these conditions, three main adjustment mechanisms were identified: an informal water market, arrangements between local government and dwellers, and public provision system distorted by corruption.

On the *needs driven* side, the informal water market was, by and large, the predominant mechanism. Based on the analysis of their operating conditions, at least five types of suppliers could be distinguished: (i) water tanks, from registered private companies; (ii) irregular water tanks (iii) water tanks owned by the local government (iv) water sold from privately owned wells (bottled water) and (v) informal sector vendors (bottled water).

Most of these activities were considered semi-formal and *needs driven*. The state was only involved in the provision of certain authorizations for registered companies and local government also acted as a water thank owner. Other aspects related to the role of the state, were simply absent. For example, overpricing and monopolization practices were encouraged by the absence of regulation schemes for the price of water.

A second adjustment mechanism was a public-community partnership. The arrangement consists of the sale of water through local government tanks at a slightly lower price than private tanks would fix. In extreme water scarcity periods, distribution of water with these tanks would be free of cost.

The third adjustment mechanism identified in 2010 was public provision of water distorted by bribery. A political group, known as Antorcha Campesina (AC), has controlled the municipality of Chimalhuacán for a long time. During the 1990s, AC encouraged an intense and illegal land invasion process in the municipality. Later, this group promoted the formalization of the new settlements and acted as a mediator between the state and the new settlements' dwellers. Its strategy consists of exchanging political support for one particular party (the Partido Revolucionario Institucional, PRI) for the introduction of public water piping infrastructure (Somuano, 2007).

In 2016, informal water markets remained as the main strategy to deal with persistent irregularities and shortcomings in the water distribution system. However, this practice has undergone significant changes. The first one occurred with the incorporation of the state as a regulator of formal—and, somehow, also informal—water vendors. In 2015, The Congress of the Edomex defined a price range for water, as a mechanism to contain speculation in the price of water sold by tanks.

A second important change can be seen in the articulation of the informal water market itself. The sprawling growth of this settlement has motivated the expansion of the informal market too, and an increase in water provider numbers can be noted. Diversification of water vendors has produced a decrease in unitary prices of bottled water.[4]

Another important modification is that the local government's water tanks started distributing water at no charge. Once a week, public tanks distribute almost 1,100 liters to each housing unit in the new settlement areas. Neighbors say that this measure is insufficient, but still, they "appreciate the effort the local government is doing".

From the *policy driven* side, the most important modification can be perceived in the local government's priorities and public agenda, in which the Antorcha Campesina group has a strong influence. After ten years of constant growth in infrastructure for water distribution, suddenly the local administration has shifted their priorities. Now, local government is prioritizing bigger, high-profile interventions, promoting a notion of progress in the public discourse.

An example of these changing priorities and paradigmas is the construction of an aquatic park and an Olympic pool in the most inaccessible portion of the settlement. The Olympic pool (including a diving area) was inaugurated in August of 2016. Behind the small houses with very limited water access, a 14,000 lt water container was installed in order to fulfill the Olympic pool and aquatic park's requirements.

[4] In 2010, a gallon of water cost $15 Mexican pesos (in 2010 prices). In 2016, a gallon of water prices cost $25 Mexican pesos (in 2016 prices).

Free water distribution and the construction of big infrastructure like the Olympic pool, allow us to infer that, at least for the time being, household water and sanitation facilities will not be a priority for local government. However, the message from Antorcha Campesina has been successful. People reportedly perceive an atmosphere of progress, associated with the construction of high-profile infrastructure, while access to water in dwellings remains insufficient, irregular, unsafe, and expensive.

Needs-driven and policy-driven mechanisms in Santiago Tepatlaxco

Like in the other case, adjustment mechanisms in Santiago Tepatlaxco are also more intensive in informal characteristics, closer to a *needs driven* classification. Since this is an irregular settlement, water access processes occur mainly without the intervention of the state, including its policies and its resources. Domestic water access occurs through a local distribution system, which inhabitants have named "Autonomous Water Management Regime".

In this settlement, water management relies on two different figures: the "Water Chiefs" and the "Water Committee". Both figures must be elected by a majority vote in a public assembly. This election mechanism gives them a broad legitimacy within the community. The operation of the local distribution system is fully financed by Santiago Tepatlaxco residents. According with Small (2006), these organization schemes are pretty common in previously rural settlements gradually absorbed by big cities.

The Water Committee in Santiago Tepatlaxco is made-up of all the Water Chiefs. This committee is the provider and administrator of water in this settlement. Its main functions are to keep a user census updated and to establish the contribution (in both, monetary and labor terms) that each household has to pay. This figure also plays a regulatory role. One of its attributions is to resolve water-related conflicts between community members. It can even impose penalties if a household does not pay the established contribution.
When a new family arrives to the settlement, the committee calls for a public assembly and the community members decide if water connection permission will be given to the new inhabitants. If permission is granted, the amount of cooperation required in exchange is established. However, it is noteworthy that since 2010 community members had refused to give connection permission to any new dwellers.

Six years later, the "Autonomous Water Management Regime" is still the dominant mechanism, even when a new informal adjustment mechanism has been identified. The new mechanism is a political exchange network based on opportunism and with electoral aims. The operation of this mechanism consists in diverse political leaders providing home construction materials (cement, tubes, etc.) for water system maintenance, in exchange for political support during electoral periods.

Although this new mechanism is notable, the most important change is related to the increase in the number of housing units. This growth explains a disproportional increase in local water demand. Water demand increases puts more and more pressure over the Water Committee. As a result, social conflict has emerged as a new element in the water access model. The increase in social conflict has diminished the committee's legitimacy. Now, new dwellers demand access to the community distribution system. In response to that, Naucalpan's local government started to send water tanks to the new areas within the settlement, further incentivizes the sprawling development tendencies.

Conclusions

Periurban spaces are becoming increasingly relevant in order to understand what water access challenges represent for complex urban areas such as the MZMC. Findings suggest that changes in water access do not depend on the intervention of one single actor. Neither the government, nor the market, nor social organizations alone are capable of dealing with the lack of water in a separate way.

We must recognize that given the metropolitan growth tendencies, traditional schemes of water provision are insufficient to fulfill the periurban population's needs, particularly in the case of poor communities. In order to deal with the unequal conditions of water access, a more flexible notion of water management policies must be adopted. This assumes that water access is based on a dynamic process of interactions and exchanges between different social actors, rather than public provision by itself. To adopt a flexible policy implies questioning the strongly held idea that water access is a synonym of water infrastructure. It requires accepting that the way the government deals with this problem in the central city is not sufficient in the poor periphery, and that a broad and flexible understanding of water access is needed. It is remarkable that both case studies evidence the way in which informality remains as the solution-oriented creative space for these communities in a context of uncontrolled urban expansion and ever-increasing demand for water.

References

Aguilar, A. G. & I. Escamilla (*cords*.) (2011) *Periurbanización y Sustentabilidad en Grandes Ciudades.* M. A. Porrúa- Cámara de Diputados- IG-UNAM. Mexico City.

Aguilar, A. G. (2008) "Peri-urbanization, ilegal settlements and environmental impact in Mexico City". *Cities*, vol. 25, Elsevier, pp. 133–145.

Aguilar, A. G. & F.M. López (2009) "Water Insecurity among the Urban Poor in the Peri-urban Zone of Xochimilco, Mexico City". *Journal of Latin American Geography,* vol. 8, No. 2, pp. 97-123.

Allen, A., J.D. Dávila & P. Hofmann (2006), *Governance of Water and Sanitation for the Peri-urban Poor: A Framework for Understanding and Action in Metropolitan Regions*. Development Planning Unit, University College, London.

Allen, A., J.D. Dávila, P. Hofmann & C. Jasko (2006b), *So Close to the City, So Far from the Pipes. The Governance of Water and Sanitation and the Peri-urban Poor*, Development Planning Unit, University College, London.
Bartlett, S. (2003). Water, sanitation and urban children: The need to go beyond "improved" provision. *Environment and Urbanization*, Vol. 15, no. 57. pp.57-70.
Conagua (2015) Situación del Subsector Agua Potable, Drenaje y Saneamiento. Semarnat- Conagua. Mexico City.
Conapo (2010) Delimitación de las Zonas Metropolitanas de México. Sedesol-Conapo. Mexico City.
Diario Oficial de la Federación (DOF) (2014) Programa Nacional de Desarrollo Urbano 2014-2018.
Escamilla, I. & C. Santos (2012) La Zona Metropolitana del Valle de México: Transformación Urbano-Rural en la Región Centro De México. III Coloquio Internacional de Geocrítica. Instituto de Geografía-UNAM. Mexico City.
Gómez-Valdez, M. & J. Palerm-Viqueira (2015) Abastecimiento de agua potable por pipas en el Valle de Texcoco, México. In *Agricultura, sociedad y desarrollo*. Vol 12, no. 4, pp. 567-586.
González, A. & A. Ziccardi (2011) Pobreza, agua y cambio climático en la Ciudad de México. Informe final. Puec-UNAM. Mexico City.
Graizbod, B. & E. Sotelo (2012). Servicios públicos y calidad de vida en las metrópolis. In: Ziccardi, A. (coord.) *Ciudades del 2010: Entre la sociedad del conocimiento y la desigualdad social* (pp. 309-348). Programa Universitario de Estudios sobre la Ciudad. UNAM. Mexico City.
Graizbord, B. & B. Acuña (2006). Movilidad residencial intraurbana en la zona metropolitana de la ciudad de México. In A. G. Aguilar (Ed.), *Las grandes aglomeraciones y su periferia regional* (pp. 235-272). M. A. Porrúa. Mexico City.
Harvey, D. (1973). *Social justice and the city*. E. Arnold. London.
Instituto Nacional de Estadística, Geografía e Informática (INEGI) (2000) *XII Censo General de Población y Vivienda.* Base de datos a nivel Registro. CD-Rom. INEGI, Aguascalientes.
_____ (2005) *II Conteo de Población y Vivienda 2005.* Base de microdatos . INEGI, Aguascalientes.
_____ (2010) *Censo de Población y Vivienda*. Tabulados Básicos. INEGI, Aguascalientes.
Ortega, N. (2010) “El agua en números” In: Boletín Casa del tiempo Vol. IV, num. 41. UAM. Mexico City.
Perló, M. & A. González (2005) *¿Guerra por el agua en el Valle de México? Estudio sobre las relaciones hidráulicas entre el Distrito Federal y el Estado de México*. UNAM/ Fundación Friedrich Ebert. México.
Somuano, F. (2007) “Movimientos sociales y partidos políticos en América Latina: una relación cambiante y compleja”, *Política y Cultura*, Primavera, no. 27, pp. 31-53.
Tiebout, C. M. (1962). *The community economic base study*. Committee for Economic Development. New York.
Tortajada, C. (2008). “Challenges and realities of water management of megacities: The case of Mexico city metropolitan area”. *Journal of International*

Affairs, vol. 61, no. 2, pp. 147-166. Consultado en: http://search.ebscohost.com/login.aspx?direct=true&db=aph&AN=32110397&lang=es&site=ehost-live
Varis, O. (2006). *Megacities and water management*. Disponible en:http://gateway.isiknowledge.com/gateway/Gateway.cgi?&GWVersion=2&SrcAuth=SerialsSolutions&SrcApp=360&DestLinkType=FullRecord&DestApp=WOS&KeyUT=000238576100012
WHO (2003) *Domestic Water Quantity, Service, Level and Health.* WHO Press. 36p. Ginebra.