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# *Water supply alternatives in the urban agglomeration of La Paz: An efficient tool for social integration and resilience of urban water management*

Sébastien Hardy<sup>1</sup>

## **Abstract**

The drinking water supply model of the urban agglomeration of La Paz is based on a large system; it is a structure that captures, produces and distributes large amounts of drinking water through a network of pipelines. This model developed in European cities by hygienists has limited efficiency in an urban agglomeration located on the edge of the semi-arid zone of the Bolivian highlands where urban growth continues at a rapid pace. In a context with an increasing frequency and magnitude of water supply crises, this article seeks to show the alternatives developed by the low-income population to have access to water and suggests that these alternative forms practiced by these sectors may contribute to resilience to water scarcity.

**Keywords:** water, crisis, discourse, decision makers, integration

## **Introduction**

The drinking water supply service of La Paz was privatized with the creation of company Aguas del Illimani and was therefore considered expensive until 2006, with many households unable to access this resource (Botton, Hardy and Poupeau, 2016). As a result of this situation, Bolivian decision makers today justify the control of this resource by the public sector. At the same time, these decision makers are alarmed by the effects of climate change in the Bolivian highlands and its consequences, particularly the availability of water resources for supplying, in a fair manner, an urban agglomeration of over two million inhabitants, with a very high rate of demographic growth. For example, throughout the water crisis from November 2016 to February 2017, decision makers repeatedly stated that this crisis was evidence of the consequences of climate change in the Bolivian highlands (Le Gouill, 2017; Perales, 2018), and that water management in the urban agglomeration must incorporate this fact, which carries with it reduced availability and greater fluctuation of this resource, as well as a fairer distribution among the population. The wealthier population consumes most of the water, while the poorest do not yet have access.

The Ministry of Environment and Water (MMAyA) uses loans obtained from multilateral banks –such as CAF and IDB– to fund many programs for a clearer understanding of the availability of water resources, including groundwater and the quality thereof (pollution due to heavy metals, urban effluents, agricultural activities), with the aim of taking measures to

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<sup>1</sup> Research officer at the Institute of Research for Development (IRD), UMR 8586 PRODIG.  
sebastien.hardy@ird.fr

make the water resources sustainable for human activities. This ministry is also in charge of implementing the National Plan for Access to Drinking Water for 100% of the Bolivian population. With this aim, it has undertaken an aggressive policy both in capturing drinking water and in expanding the drinking water distribution network in urban areas of the La Paz agglomeration which have not yet been served (Le Gouill, 2017). National authorities seek to fulfil the objective of water for all set forth in the 2016-2020 Economic and Social Development Plan, thus demonstrating that they have internalized the notion that a large system for drinking water production and distribution through pipelines must necessarily be the norm of modernity in water supply (Hardy and Poupeau, 2013).

However, observations and surveys conducted in the urban agglomeration of La Paz in the first half of 2019 indicate that although the drinking water supply by means of the large system for drinking water production and distribution through the mains network (Hardy, 2015) improved between the censuses of 2001 and 2012 –with a coverage rate of over 90% of households in La Paz and almost 89% in El Alto in 2012– numerous households continue to be excluded from the service because of their location in areas without coverage and/or due to a lack of financial resources for accessing it. This situation forces those residents to develop alternatives to the piped network for obtaining water; these alternatives correspond to the different uses made of this resource in homes. Seeking water based on its different uses facilitates access, as it implies more dispersed efforts and less energy invested in the search: small quantities need to be found for a great variety of uses. The efficiency in the strategy of access to water is enhanced. Given these conditions, this article seeks to demonstrate that the alternatives to a large system for drinking water production and distribution constitute a powerful tool for integrating sectors considered marginal into the city, and may even be pioneering elements in resilient management of water for a city located in a semi-arid zone.

The aim is also to show that these alternatives, which respond to the rationale of infrastructures outside the network (Coutard and Rutherford, 2013) enable –contrary to the conclusions reached by decision makers– a better integration of the population, facilitating what the La Paz centralized traditional network does not allow (Coutard, 2005).

The first part of the article will present the situation of access to water in the La Paz agglomeration, considering its evolution over a decade. The second part will show how many households of the agglomeration that do not have access to drinking water from the network of the large system develop alternatives based on the different uses of water. The third part will focus on the advantages provided by the alternatives of consuming water in a more resilient manner in an agglomeration located in a semi-arid zone, changing the notion of modernity of the large system for drinking water supply imported from the Western world and pursued by the national authorities.

## **1. Who are those accessing drinking water, and where, in the urban agglomeration of La Paz?**

### **1.1. Better access to drinking water in the urban agglomeration of La Paz**

The coverage of access for the inhabitants of the urban agglomeration of La Paz to drinking water through the network increased sharply between the 2001 and 2012 Censuses. In

2012, the coverage rate reached 91.66% in the municipality of La Paz and 88.35% in El Alto (INE, 2012), displaying a growth from 85.7% and 81% respectively compared to 2001 (Hardy and Poupeau, 2017). These figures indicate that despite its shortcomings (Hardy, 2009), the large system for the supply of drinking water of the La Paz conurbation, managed by a public company (Hardy, 2015), is capable, under normal operating conditions, to provide a large amount of good quality water for human consumption. Despite an increase of 30.1% in the urban population of El Alto from 2001 to 2012 (INE, 2012), the La Paz public company for the production and distribution of drinking water was able to expand the network and its coverage, which led to a greater production of drinking water, demonstrating the system's high degree of efficiency.

This efficiency of the large system for drinking water production and distribution was made possible by very costly investments for collecting even more drinking water (Map 1) and for expanding the distribution network to connected homes without increasing connection tariffs or the cost of water per cubic meter sold to the households.

#### Map 1. Production and distribution of drinking water

Since 2006, the Bolivian governments have set the goal of 100% access to drinking water for the Bolivian population. To reach this objective, they have promoted a policy of expanding the networks of water supply companies (Ministry of Planning, 2015) and of the Public and Social Water and Sanitation Company (EPSAS S.A.) in the area comprising the urban agglomeration of La Paz. To support the water supply companies, in its 2016-2020 National Development Plan, the Bolivian government has planned an investment of 10% of the national budget in the water sector, amounting to approximately USD 4.8 billion (Ministry of Planning, 2015). Added to this amount are the investments in the water sector provided by the bilateral (Venezuela, etc.) and multilateral (European Commission, etc.) donor community. In April 2019, the Minister of Environment and Water, Carlos Ortuño, one of the chief ministers of Evo Morales's government, informed that close to 2 billion euros had been invested in access to water for the Bolivian people (*Página Siete*, 8 April 2019). These investments have been fruitful despite the fact that their effects take time to materialize due to the limited institutional and technical capacities of the main actors in the country (Le Gouill, 2017; Agramont, Craps, Balderrama, and Huysmans, 2019; Perales, 2018), i.e. the national (Ministry of Environment and Water) and local (EPSAS) entities: they have generated investment plans and delivered the initial achievements. For the urban agglomeration of La Paz, the main achievement has been the expansion of the drinking water distribution network in El Alto, and, following the water crisis from November 2016 to February 2017, new infrastructure, including new water catchments and reservoirs (Le Gouill, 2017). In April 2019, Evo Morales, President of the Plurinational State of Bolivia, inaugurated the Pampalarama reservoir, built in the basin of the Kaluyo stream, which will presumably ensure water for covering the needs of the municipality of La Paz for the next 30 years. In July 2018, the water purification plant of Chuquiaguillo was inaugurated (*Página Siete*, 14 July 2018). In El Alto, groundwater exploitation through the drilling of new wells helps to unobtrusively expand the large system for the distribution of drinking water to cover the demand of this city (*Página Siete*, 8 April 2019).

The strategy of these investments has been and continues to be to increase the volume of drinking water collected; it ignores the different scientific studies published, the results of which converge and warn about a reduction of the quantity and quality of the water available in the region of the urban agglomeration of La Paz in the medium term (Hunt and Watkiss, 2011; Copana Paucara, 2018; Perales, 2018).

## **1.2. Areas with no network-based water coverage**

Without downplaying the progress mentioned above, according to the 2012 Census, a portion of the population does not yet have access to drinking water through the large system of production and distribution of the urban agglomeration. Several reasons explain this fact.

The pace of expansion of the urban agglomeration has at times exceeded that of the large system: the zones become urbanized and populated in an unplanned manner and faster than the technical possibility of installing drinking water distribution networks.

### Map 2. Households with no connection to the public drinking water network

Map 2 is based on the data of the 2001 Census due to the non-existence of an equivalent level of information at the neighborhood level with data from the 2012 Census. The map shows that in the peripheral areas of the urban agglomeration, both in El Alto and La Paz, the most recently developed neighborhoods are less connected to the drinking water distribution network. Although the rates of connection of homes to the drinking water distribution network improved from 2001 to 2012, reaching 91.66% in the municipality of La Paz in 2012 and 88.35% in El Alto (INE, 2012), it is extremely likely that the peripheral areas continue to be the least connected urban areas. National highway No. 2 linking El Alto with Batallas and then Lake Titicaca is an example of the present situation. The new buildings stretch for kilometers from El Alto to Batallas (along the highway) before the housing development becomes denser in depth (perpendicular to the highway). This unplanned urbanization is occurring at a pace quicker than network installation. And this pattern of urban expansion is arc-shaped going from west to south, from El Alto to the highlands, along the main highways. In a workshop organized by CIDES in March 2018, municipal authorities of El Alto admitted to an average rate of unplanned urbanization of approximately 16 hectares (0.16 km<sup>2</sup>) per week.

What is more, when the drinking water systems are able to keep up with the pace of urbanization, people must be able to free up resources in order to connect to them. The public company EPSAS offers three tariffs for connecting to the distribution network. Despite the criticism of Aguas del Illimani during the *Water War* of El Alto, the nationalized company continues to offer a regulated tariff in peripheral urban areas with a matching contribution from users in terms of the connection work. The rate is EUR 91.50 (BOB 698.52<sup>2</sup>). And for more consolidated urban zones, the connection tariff ranges from EUR 101.10 (BOB 771.62) to EUR 133.37 (BOB 1,018.08), equivalent to between one-half and one-third of the monthly minimum wage (BOB 2,122 or EUR 278 in 2019). Many households in the La Paz conurbation simply do not have the financial resources to pay for

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<sup>2</sup> At August 2019, BOB 1 equalled EUR 0.13.

this connection or the drinking water consumption invoices. In such cases, the residents must seek alternative supplies of water (drinking water or not).

## **2. Residents seeking alternatives to the drinking water distribution network**

### **2.1. Some examples of alternatives, providing drinking water savings**

Although the state of household access to the drinking water distribution network in the urban agglomeration of La Paz has improved considerably over the past decade, many homes do not yet have connections or have poor connections, which is partly attributable to the pace of growth of urbanization and population. Given this situation, the residents get organized, seek and find alternative supplies of water for drinking and other uses. They use small amounts of potable water for drinking, through the purchase of bottled water –the market for which is growing considerably, keeping pace with urbanization– and large amounts of unsafe drinking water for domestic uses such as laundry, for which it is not necessary that the water be drinkable. Numerous studies have been done in several districts of La Paz and El Alto (Map 1) on the cooperatives that supply water as alternatives to the large system (Hardy and Poupeau, 2013, 2014, 2016, and 2017). Consequently, this article seeks to explore other alternatives.

New surveys have revealed that due to the lack of resources for having an own individual connection, some homes located in neighborhoods served by the drinking water distribution network continue resorting to the collective taps installed in their neighborhoods. This is the case, for example, of the district of Ovejuyo in La Paz. To illustrate this variety of alternatives, the present article paid particular attention to the mentioned neighborhood, where some analyses have already been performed in recent years (Vettraino, 2012). This district was one of the zones with few connections to the large system for drinking water distribution in 2001 (Map 1). Although the situation in terms of connections to the large system has improved, the residents of this peripheral district belong to low-income population segments. Moreover, the distance from the district to the center of the city, where health services and employment are to be found, forces them to invest more in transportation, at the expense of other services such as access to an individual connection to the drinking water distribution network. They thus organize to pay for connections to the EPSAS drinking water distribution network through collective intake devices (Photo 1).

Photo 1: Residents of the peripheral district of Ovejuyo, La Paz, who are connected to the EPSAS drinking water network obtain drinking water from a public tap because they cannot afford an individual connection

(S. Hardy, 2019)

Sometimes the residents live in areas served by the drinking water distribution network, but the costs of connection and drinking water consumed invoiced by EPSAS exceed the household resources available, leaving these residents with no solution but to seek alternatives to the water supply network. It has been seen in the district of Ovejuyo that many households have rainwater harvesting strategies, storing this water in containers with different capacities, according to their financial possibilities. Some residents even have tanks to store several thousand liters (Photo 2).

Photo 2: Rainwater harvesting strategy as an alternative to the drinking water distribution network

(S. Hardy, 2019)

Water collected in reservoirs can in some cases cover the drinking water needs of the poorest households of the district, particularly during the rainy season, when water is abundant and is replenished on a daily basis; however, generally and with greater frequency, it is employed for domestic uses, such as cleaning the home's courtyard or laundry, for which good quality water is required, but it need not be safe drinking water.

Through observations and surveys done in the district of Ovejuyo, the conclusion is that the population of the urban agglomeration of La Paz is developing water access strategies outside the EPSAS large system of distribution. Evidently, the water obtained is not always drinkable, but this is not necessary, as it suffices that water for daily domestic uses be of good quality. Households that resort to these strategies save money and inadvertently participate in conserving the water resource of the urban agglomeration through the consumption of water available in the vicinity.

### **3. The variety of alternatives: between resourcefulness and limited resources**

#### **3.1. Alternative strategies of access to water for the poorest households**

A study performed in the La Paz district of Ovejuyo brought to light the alternatives for access to water employed by the poorest households due to a lack of connection to the EPSAS large system for drinking water distribution or simply because they have no money to pay for the service of the water network.

It is possible to reverse the significance of these observations. The use of alternatives to the drinking water distribution network is the result of a specific perspective: that of the observer who has always had access to the drinking water distribution network. However, many groups of inhabitants of the recently urbanized urban agglomeration have never had access to the network. For these residents, the large system for drinking water distribution is the most convenient and safe alternative to what has always been their daily access to water. Nonetheless, these alternatives are interesting for the observer, from the angle that through them an urban agglomeration such as La Paz can become more resilient in its urban water management.

For example, some residents of the urban agglomeration use, since they have no access to the distribution network and/or no money, the water from the numerous streams crossing the city to do laundry. The quality of that water somehow leaves much to be desired; however, some adaptations, such as diversions of the water flow patterns to pockets that filter the water, allow having water of sufficient quality for some domestic uses such as washing clothes. This can be observed in many parts of the urban agglomeration of La Paz (Photo 3). Based on the quantities of laundry and the interviews conducted, we can conclude that there is considerable laundry being done in the city making use of these

facilities as alternatives to individual washing machines that consume a great deal of drinking water.

Photo 3: Washerwomen using water from the Choqueyapu River, filtering the water into rocky pockets to obtain water which is not drinkable but of sufficient quality for washing large amounts of clothes

(S. Hardy, 2019)

The transportation sector is another important user of good quality water. The establishment of a massive transportation system in the urban agglomeration of La Paz is relatively recent; it took place in the years 2014-2015 with the introduction of the municipal bus systems: Pumakatari in La Paz and Wayna Bus in El Alto, and with the start of operations of the urban cable car network between El Alto and La Paz. This system is however far from sufficient for covering all the transportation needs of the urban agglomeration's population and has not replaced the previously existing system which continues to operate in parallel with the mass transport system. This private system is made up of a great number of minibuses, large buses, shared and individual taxis, managed by cooperatives covering routes negotiated with the municipal authorities (Núñez-Villalba and Demoraes, 2009). This privately-owned automobile fleet is made up of tens of thousands of vehicles that travel several dozens of kilometers each throughout the day. Their maintenance demands daily cleaning, which means they are large water consumers. These washing operations do not require the use of drinkable or good quality water. Besides, such use of drinking water would make this maintenance task very costly, affecting the profitability of the transport activity. Hence, it is common to see the drivers of the private transportation system of the urban agglomeration grouped together around springs, washing their vehicles. They can be seen for example on the street connecting Avenida Libertador with Avenida Saavedra (Photo 4) and on adjacent streets.

Photo 4: A taxi and a fleet of minibuses on a La Paz street using water from a spring for their daily vehicle washing operation

(S. Hardy, 2019)

The urban agglomeration is also a national transportation hub, generating a considerable amount of transport activity via inter-departmental and international highways. Trucks crossing Bolivian and international highways (such as the one connecting to the port of Arica) also require washing, and an activity of washing heavy trucks has been structured in response to this demand. This activity depends less on water from springs and more on the rivers from which non-drinking water is pumped for industrial cleaning, as is the case of the Seco River in El Alto or the Irvavi River (Pellicer, 2019)<sup>3</sup>. This free water generates income for those exploiting it, and because the services offered by these washing stations have a better quality-price relationship than those offered by stations employing water from the network, they benefit users. Tens of thousands of vehicles consume water from these sources of non-drinking water on a daily basis and, therefore, do not affect the drinking

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<sup>3</sup> Information from a survey conducted in the work of Pellicer



water supply of public company EPSAS, which then has more water for drinking water purposes.

### **3.2 The municipality of La Paz, a massive promoter of alternatives to the network**

The municipality of La Paz is an institutional network user. It requires good quality water for its office buildings, schools and health centers. That water is obtained, for example, directly through the transfer of central powers of the State to the municipalities. But there is also a broad range of uses that do not require drinking water. And the alternatives to the network reduce the amounts paid by the municipality to EPSAS.

Thus, the municipality is making increasing use of spring water. The many water supply crises that have affected the urban agglomeration of La Paz (Hardy, 2009 and 2011; Le Gouill, 2017; Perales, 2018) in recent years have undoubtedly contributed to this change in water supply practices in the area of the municipality of La Paz.

Every day, including Sundays, a large number of tank trucks belonging to the municipal government of La Paz or rented by it collect water using electric pumps at springs. One of these springs is located, for example, at Avenida Hernán Siles Zuazo, south of the La Salle school (Photo 5). There is another such location on Avenida Del Poeta, next to the spring at the Grotto of the Virgin of Lourdes. Having collected the water, these tank trucks then distribute this resource in the city, watering parks and gardens, providing water for municipal public works sites, etc. For these uses, the water must be of good quality, but it must not necessarily be safe drinking water.

Photo 5: A motor pump used to fill a tank truck with non-drinking water from a spring which is then used by the municipal government of La Paz for city uses requiring good quality water

(S. Hardy, 2019).

The municipal authorities of La Paz are aware of the issues related to the alternatives to the drinking water distribution network. In the first place, because of the lower cost, and in the second place, and increasingly so, because of the exploitation of good quality resources for uses not requiring drinking water. Thus, in 2019, a municipal ordinance was passed to improve the water collection from the spring at the Grotto of the Virgin of Lourdes and to prohibit the private transport sector from exploiting this resource. The importance of this alternative for managing a city in a semi-arid zone seems to be slowly finding its way into people's minds (Lorrain, Halpern, Chevauche, 2018).

### **Conclusion**

Bolivian national authorities have incorporated the notion that the large system for drinking water production and distribution through the mains network –a Western model inherited from the hygienist movement– represents modernity and is the model to be followed to grant 100% of the Bolivian population access to drinking water. Given this conception, the

national authorities do not consider alternatives to this model, which would be interesting in order to promote more resilient water management in the Bolivian cities. Water uses differ, and certain alternatives are sometimes innovating solutions adapted to local conditions on the ground, to the limited ability to pay on the part of certain users, and to the lack of property deeds (Criqui, 2014). Often these alternatives are perceived as second-class solutions for second-class citizens, ignoring that on the contrary, they reflect the resourcefulness of residents to preserve a resource and make cities more resilient.

Added to this, in the context of La Paz, where water quantity and quality are problems, the exploitation of certain alternatives, for uses in which the water quality should be good, could have a positive effect on the general quality of this resource by making its production less costly.

Taking into consideration the water resource alternatives to the present network, which are already being partially used by some residents for certain uses, in the context of climate change, could open up a range of water supply solutions for all.

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