Investigation note

Water marketing by pipes in the East of the Valley of Mexico

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Abstract

Given the water restriction in the Valley of Mexico, where population groups do not have access to water distribution networks or access is restricted, a market for water supplied by tank cars (pipes) is generated. The objective was to analyze the marketing and supply chain of the water distributed by pipes in the East of the Valley of Mexico with data obtained in 2017, as well as the participating agents. The direct method of the marketing channel was used following the product since it is extracted from the well, sold to the “piperos”, who transport it and sell it to the final consumer. The owner of a well was interviewed and fifty interviews were conducted with piperos, with the information the costs incurred by each agent, as well as the respective profit margins and rates, were calculated. It was found that the highest absolute margin per m^3 is obtained by piperos ($52.63) while the pocero is smaller ($14.75). However, when weighting the margins for the respective costs, the highest profit rate (1 180%) is obtained by the pocero, while that of the piperos is lower (206%). It is concluded that the water market supplied by pipes is extremely profitable, because it is not a regulated market, and that if public policies were established through regulation, liquid prices could be reduced in favor of consumers.

Keywords: marketing margins, profit rates, water pipes.

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Water is currently a resource that occupies the attention of different human groups, due to the need to satisfy its use in the domestic, agricultural and industrial sectors. Population growth and increased needs for human consumption have converted water resources into scarcer and more expensive goods (Caballer and Guadalajara, 1998).

The Valley of Mexico, at present, concentrates a population of 22 million people (OECD, 2015) and its average annual rainfall is 682 800 m^3 where 72% evaporates, 4% recover in surface water, 14% drains and 11% infiltrates to recharge aquifers (CONAGUA, 2010). The sources of water supply in the area are local aquifers, smaller reservoirs and transfers from other basins that together contribute 81.9 $m^3 s^{-1}$ (2583 $hm^3 year^{-1}$), to which 6.1 $m^3 s^{-1}$ of wastewater are added (CONAGUA, 2010). This means that the Valley of Mexico has the lowest water availability per inhabitant per year, just 186 m^3 $inhabitant^{-1}$, while in states such as Chiapas there is 24 000 m^3 $inhabitant^{-1}$. The above, makes the Valley of Mexico present a situation of extreme water stress (SEMARNAT, 2008).

The supply of water to the Valley of Mexico is carried out by surface and underground water, where the volumes that enter from other basins have macro measurement systems operated by the Water Commission of the State of Mexico (CAEM) and CONAGUA, while the macro measurement of water supplied by deep wells-operated by local agencies-is relatively low (INDEFEM, 2005). In most cases, the operating agencies are unaware of the actual performance of the wells and the amount of water they inject into the system, something worrisome given the high levels of overexploitation of the aquifers (Gómez-Valdez and Palerm-Viqueira, 2015).

The solution to the water problem cannot include only the exploitation of aquifers and the importation of water from distant watersheds, solutions are needed that involve society, economy and culture for the efficient management of the resource, for example, through reduce inequality in access to drinking water between social groups and promote the payment of real prices for consumers connected to the network and consumers by pipe (Izazola, 2001).

The investigation focused on the East of the Valley of Mexico, which is part of the Alto Panuco hydrological region, within the sub-basin of the Moctezuma River. The area does not have permanent rivers and only temporary streams appear during the rainy season. In the sixties, the region was rural type and over time the rivers that irrigated the land were depleted by overexploitation, in such a way that the water supply is currently carried out by the drilling of deep wells, which face strong pressure from the overexploitation of recent years. It is estimated that 97% of the water is extracted from the subsoil through 26 deep wells, which are not regulated (IFEDEM, 2005). This has led to the development of a water market through the commercialization of water transported by pipes, which distribute the liquid to new urban settlements that do not have a connection to the public water supply network or that supply it is deficient.

The objective of the research was to analyze the marketing and supply chain of the water distributed by pipes, as well as the participating agents. As a hypothesis, it was established that the supply of water by pipes, being an unregulated activity and corresponding to an informal market, generates different asymmetries in terms of the appropriation of value among the different agents participating in the supply chain.

In the analysis of the commercialization of water extracted from deep wells and commercialized by pipes in the East of the Valley of Mexico, the direct method of the marketing channel was used, that is, the product (water) was tracked since it was extracted from the well sold to the piperos that transport it and sell it to the final consumer.

To obtain the data, we interviewed the owner of a well in the East of the Valley of Mexico, which has a depth of 122 m and a water mirror at 78 m. Additionally, 50 questionnaires were applied on a census basis; that is to say, that we did not work on a statistical sample, but on the total population (INEGI, 2011), to the same number of pipe operators, where they were asked questions such as the price at which they buy the pipe load, capacity of the same (in cubic meters), distances traveled, salary that they receive (if they are not the owners of the vehicle), consumer to whom they sell the product and sale price of the same.

To calculate the costs incurred by the pocero, the total cost per hour of the operation of the hydraulic infrastructure was obtained, which consists of the drilling of the well, motive equipment and electric motor, vertical pump and works and accessories (motor base and pool). In this calculation, the rescue values and the depreciation of the same will be obtained; additionally, the cost of the electricity used in the operation of the pump for the extraction of one cubic meter of water will be added, since all the calculations will be referred to that unit of measurement. The cost of the labor required in the handling and loading of one m^3 of water to the pipes will also be taken into account.

In the calculation of the costs incurred, the depreciation cost of a pipe with capacity to transport 10 m^3 will be included and the cost will refer to only one m^3. In addition, the cost of diesel required and the labor of the driver of the unit for the transportation of one cubic meter of water will be added. With the calculation of the costs for each agent and the sale prices in each stage, the respective margins will be calculated using the formula:

$$MA=PV-C$$

Where: MA is absolute margin, PV sale price and C cost or purchase price. Additionally, the profit rates for each agent (%) will be calculated by dividing the respective margins and weighing them by the costs incurred by each agent.

The owner of the well (pocero)

The pocero stressed that it has a well with a depth of 122 m and the water mirror is 78 m, plus that each year the water level drops 1 m on average. It supplies pipes with a capacity of 10 m^3 (those with smaller capacities are almost non-existent) and a hundred pipes are filled every day, so the average daily sale is 1 000 m^3. This well is operated by an 8” pump and extracts an average of 50 L s^{-1} (Table 1).

The infrastructure consists of drilling the well at 122 m depth (initial cost $610 000.00), electric motor and magnetic starter ($20 000.00), transformer ($23 000.00), vertical pump type turbine 8” ($90 000.00) and infrastructure accessory: high discharge tank with 80 m^3 capacity and motor base ($205 000.00).

Table 1. Private costs of capital recovery of pumping equipment.

Characteristics	Drilling (122 m)	Motive equipment and electric motor (magnetic motor and transformer)		Vertical pump (turbine type)	Accessory works (base for pipette motor)	Total
Initial cost ($)	610 000.00	20 000.00	23 000.00	90 000.00	205 000.00	
Rescue value ($)	61 000.00	2 000.00	2 300.00	9 000.00	20 500.00	
Present value of rescue ($)	5 630.00	771.00	887.00	5 588.00	3 047.00	
Net cost ($)	604 370.00	19 229.00	22 113.00	84 412.00	201 953.00	
Capital recovery factor	0.11	0.163	0.163	0.264	0.117	
Annual recovery ($)	66 582.00	3 129.00	3 599.00	22 268.00	23 721.00	
Partial cost per hour ($)	18.24	0.86	0.99	6.10	6.50	
Total cost per hour ($)						32.68
Total cost of operation						0.18
Electric cost						0.66
Labor cost						0.40
Total cost of extraction and sales ($ m^{-3})						1.25

Elaborated with data provided from a water well located in the East of the State of Mexico.

The useful life considered in years was between 5 and 25 years depending on the infrastructure or tool valued and the hours were obtained by multiplying the number of years by days and then by the ten daily hours of operation of the well. The interest rate of the refactional credit to which the trusts instituted in relation to agriculture (FIRA) lends money (7%) plus a risk premium of 3%: which yields a total rate of 10%. The sum of the recovery of each of the items of the hydraulic infrastructure (18.24 + 0.86 + 0.99 + 6.10 + 6.5) generates the total cost per hour of the operation of the hydraulic infrastructure, which is $32.68 (Cudro1).

The hydraulic infrastructure throws 50 L s^{-1}, which for one minute will generate 3 000 L, which amount will be 180 000 L, or 180 m^3. By dividing the $32.68 cost per hour by the number of cubic meters extracted in one hour, we obtain the cost per cubic meter of the operation of the infrastructure, which is $0.1815 (Table 1). The cost of labor is calculated by hiring two people to cover two shifts per day (each of 12 h) with a salary per shift of $200.00, which makes a total daily work expense of $400.00. If a thousand cubic meters are extracted and dispatched daily, then the expenditure per m^3 is $0.40 (Table 1). The total expense for extracting and discharging one m^3 of water is the three previous items, and this is $1.25 (Table 1).

Private costs of transporting water from the well to consumers

In this process of transporting the liquid from the well to the consumers, the so-called "piperos" intervene, who transport the water through tank cars with a capacity of 10 m^3. The pipe of 10 m^3 has a cost in the well of $160.00; that is to say, that the cubic meter has a price of $16.00. The piperos to deliver the water perform on average a route of 19.45 km, and make approximately three trips per day, therefore, its load capacity per day is 30 m^3. The average sale price of the contents of the pipe is \$686.32, which is equivalent to \$68.63 m^{-3}.

You get the depreciation of the pipe with a cost of \$1 259 700.00 (according to the agency) and a useful life of 10 years, finally you get a partial cost per hour of \$25.91, which multiplied by the six hours that the pipe works It shows a daily cost of \$155.45, the same to be divided among the 30 m^3 transported per day (for the three trips they make) originates the cost of \$5.18 per m^3 transported (Table 2).

Table 2. Private costs of capital recovery of the pipes.

Equipment	Water pipe 10 m^3 Durastar 2017	Gas (diesel) 378l	Workforce for m^3
Initial cost	1 259 700.00		
Rescue value (\$)	125 970.00		
Interest rate (OP)	0.10		
Present value of rescue (\$)	48 567.00		
Net cost (\$)	1 211 133.00		
Capital recovery factor	0.163		
Annual recovery (\$)	197 106.00		
Partial cost per hour (\$)	25.91		
Cost per day (\$)	155.45		
Cost of the pipe per m^3	5.18	10.77	9.56
Total cost of transporting (\$ m^{-3})	25.51		

Elaboration with data provided by piperos.

In the Table 2 shows the diesel expense per m^3 transported. The pipe performs an average of 19.45 km for the delivery of water, when making three trips a day, it makes an empty route of 58.3 km and the same distance charged. Because empty has a performance per liter of diesel of 7 km and with load its performance is of 5.5 km, then the daily cost of loaded and empty diesel is of 10.61 L and 8.34 L, respectively, in total it constitutes a daily expenditure of fuel of 18.94 L. With a diesel cost of \$17.06, the total fuel expense is \$323.20, which when divided by the 30 m^3 transported, costs \$10.77 per m^3.

In the survey conducted to piperos, it was found that those who do not own the pipes only charge a salary for serving as drivers of these the average daily salary is \$286.80. When dividing, the daily salary accrued by the piperos, between the 30 m^3 transported, there is a labor cost of \$9.56 per m^3 transported (Table 2). The total cost of one cubic meter of water transported from the well to the consumer is the sum of the pipe depreciation (\$5.18), plus diesel (\$10.77) plus labor (\$9.56) which together total \$25.51 per m^3 (Table 2).

Marketing margins

The buyer sells for \$16.00 m³, if he has extraction costs for \$1.25 m³, then his absolute margin is formed by the subtraction of the sale price minus the costs, which is 14.75 per m³ (Table 3). The pipette sells to consumers at \$68.63 m³, and buys the buyer said m³ at \$16.00, then its absolute margin is \$52.63 m³. From the results obtained it is observed that the highest absolute margin is obtained by the piperos, while the margin of the pocero is smaller (Table 3).

Margin profit rates

If each marketing margin is weighted by the costs incurred by each marketing agent, then the respective profit rates are obtained. As shown in Table 3, the marking of good water extraction and commercialized by pipes is an extremely profitable market and the well man obtains the highest profit rate by incurring lower costs.

Table 3. Absolute margins and absolute profit rate in the commercialization of water by pipes in the East of the Valley of Mexico.

Marketing agents	Costs (\$ m^{-3})	Absolute margin (\$ m^3)	Profit rate (%)
Pocero	1.25	14.75	1 180
Pipero	25.51	52.63	206.3

Elaboration based on interviews with marketing agents.

The works that have been carried out with respect to the commercialization of water by pipes are almost null, nevertheless, the one made by Gómez-Valdez and Palerm-Viqueira (2015), stands out, who presented a study on the supply of drinking water by pipes in Valley of Texcoco, addressed the issue from the social point of view, where they conclude that the supply of pipes reduces the pressure on the demand for efficiency of water supply.

On the other hand, it is known that the non-existence of a formal market is the rational response to transaction costs that exceed the potential commercial gains (Dourojeanni and Jouravlev, 2002). Therefore, the profitability of the transfers is reduced, as well as the total volume of profit between well and pipette - making even greater the profit of the well (Collentine, 2007). The participation of externalities linked to the transfer of water to ensure social benefits must be carried out by buyers and sellers, however, there must be “government supervision of water transfers would have social interest” to ensure it (Huaman *et al*., 2015).

The water market allows for a “fluid” reallocation of water rights from low-valued uses to more valuable ones, offering in basins, in principle, saturated supply alternatives to meet the growing demands for water that presents activities of great economic and social importance, as the supply of drinking water, efficiently using the resource (Dourojeanni and Jouravlev, 2001).

Conclusions

Due to the scarcity of water in the Valley of Mexico, a market has been generated for the extraction of water from deep wells and commercialized by tank cars (pipes) to consumers. This market is highly lucrative and in the commercialization of the liquid the highest absolute margin is obtained by the piperos and to a lesser extent the owners of the wells. However, when weighting the margins between the costs incurred by the commercial agents, the highest profit rate is obtained by the wells, because they have lower costs in relation to the piperos.

The costs and profits incurred by the agents in the sale of water by pipes were highlighted, highlighting the wide margin of profit that each one has, which suggests that they are profiting from the need of the population for the hydric resource; however, if the government intervened; through public policies in which a regulatory framework was established, the profits of the agents would decrease what would directly benefit the consumers, giving them certainty of the supply of the resource, as well as maintaining a fixed tariff either per cubic meter or per daily consumption and the protection of the natural resource by controlling the quantity extracted from the wells and using part of the income for water consumption for protection measures of water sources.

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