



Organizational effectiveness evaluation in Mexico City's drinking water system

Evaluación de la efectividad organizacional en el sistema de agua potable de la Ciudad de México

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Received: 12/01/2018 • Approved: 10/07/2018

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ABSTRACT:

The aim of this paper was to evaluate organizational effectiveness in Mexico City's drinking water system, from the directors of the water sector in its 16 boroughs. Through an exploratory and descriptive research, it was designed a statistically validated instrument to measure this phenomenon. Results showed the most affected boroughs and proposals were made for improvement in programs, searches of water sources, proper budget allocation and compliance with norms.

Keywords: Drinking water, evaluation, organizational effectiveness.

RESUMEN:

El objetivo de este trabajo fue evaluar la efectividad organizacional en el sistema de agua potable de la Ciudad de México, a partir de los directores del sector de agua en sus 16 delegaciones. A través de una investigación exploratoria y descriptiva, se diseñó un instrumento validado estadísticamente para medir este fenómeno. Los resultados mostraron las delegaciones más afectadas y se propusieron mejoras en los programas, búsquedas de fuentes de agua, asignación presupuestaria adecuada y cumplimiento de las normas.

Palabras clave: Agua potable, evaluación, efectividad organizacional

1. Introduction

Organizational effectiveness is a very important term in administration because any kind of organization continually seeks to improve its performance (Manzoor, 2012; Lecy, Schmitz, & Swedlund, 2012; Robbins & Coulter, 2015). Effectiveness approaches differ depending on whether an organization is public or private. However, there are similar elements applicable to both organizations with adaptations according to the context used (Coulter, 1979; Blunt, 1990; Provan & Milward, 2001; Heinrich, 2002; Parhizgari & Gilbert, 2004).

Of particular importance is the water sector in Mexico City because it is the capital of Mexico,

the federal entity and the seat of the federal powers divided into 16 boroughs, each one with a director in charge of managing water in its demarcation (Administración Pública del Gobierno del Distrito Federal, 2013), which has a population of 8, 918,653 inhabitants, being the second most populous demarcation, so it requires huge resources and administrative strategies to provide water in sufficient quantity and quality to people (Administración Pública del Gobierno del Distrito Federal, 2013; Comisión Nacional del Agua, 2014; Instituto Nacional de Estadística y Geografía [INEGI], 2015).

The population of Mexico City has been increasing in recent years and the water distribution is not homogeneous; Iztapalapa residents receive 200 liters per day, while some areas of the west of the city receive more than 350. Similarly, 180, 000 inhabitants do not have effectiveness because they do not have a pumps and pipes system that enable the installation of domestic outlet, and there is also a lack of water in the system, clandestine flows and unaccounted drinking water. The water system faces major challenges related to difficulties inherent in the subsoil, the floating population, the infrastructure age, the declining volumes in supply sources and the increase of hydrometeorological hazards (INEGI, 2010, 2015; Sistema de Aguas de la Ciudad de México, 2012a; Administración Pública del Gobierno del Distrito Federal, 2013).

In literature there are not enough models applied to organizational effectiveness in the water sector, and the few founded are more focused on operational aspects of the resource, rather than focusing on water management (Baietti, Kingdom, & Ginnekenm, 2006; American Public Works Association et al., 2008; Organisation for Economic Co-operation and Development [OECD], 2013). The objective of this research is to evaluate organizational effectiveness in the water sector, in Mexico City's drinking water through its 16 boroughs, in order to establish strategies to improve it. To achieve this, the main concepts and models of organizational effectiveness in literature are discussed and an instrument is designed to measure the phenomenon.

1.1. Organization and effectiveness of water management organizations in Mexico City

Mexico is a country with 31 states and a Federal District or Mexico City. This city is the seat of the federal powers and capital of the Mexican Republic divided into 16 boroughs, each with its own elected government representing a political administrative organ of each territorial demarcation. In addition, it is located in the Metropolitan Area of Mexico, the largest urban area and the main political, economic, scientific and cultural center of the country (Administración Pública del Gobierno del Distrito Federal, 2013; Ley de Aguas del Distrito Federal, 2015). The city has a population of 8, 918,653 inhabitants (INEGI, 2015) and it contributes 16.40% to the gross domestic product in Mexico (Comisión Nacional del Agua, 2014).

Mexico is divided into 13 hydrological-administrative regions, which are formed by groups of basins, considered the basic management units of water resources. The National Water Commission, administrative organ, regulatory, technical and advisory responsible for water management in Mexico, performs its duties through thirteen basin organizations whose remit are the hydrological-administrative regions. Mexico City is located in the hydrological-administrative region number 13, Waters of the Valley of Mexico, and it receives 31.2 m³/s of water. The sources of drinking water are the Cutzamala system in which is extracted 9 m³/ s; of the system of wells in Barrientos 2.1 m³/s; of the Caldera 0.6 m³/s; of the Lerma River 4 m³/s, 0.9 m³/s of the Chiconautla system, as well as the springs and wells located in Mexico City with 14.6 m³/s (Sistema de Aguas de la Ciudad de México; 2012b; Comisión Nacional del Agua, 2014).

The Water System of Mexico City is a decentralized agency of the Federal District Public Administration, attached to the Secretariat of Environment and Natural Resources, whose main purpose is the operation of water infrastructure and provision of public drinking water, drainage and sewerage and treatment and wastewater reuse, which can act as an auxiliary of the Secretariat of Finance in respect of water services (Ley de Aguas del Distrito Federal,

2015). The system has 9 managements directly involved in drinking water management which are coordinated with the water managements of the 16 boroughs of the city (Sistema de Aguas de la Ciudad de México, 2010).

Each of the boroughs, in the hydraulic management, is responsible for designing and implementing the borough works programs for water supply and sewerage services and sanitation, providing in its territorial demarcation services of water supply and sewerage, disseminating information and promoting cultural activities, environmental education and training, among others (Ley de Aguas del Distrito Federal, 2015). For organizational effectiveness, the city has used a manual to increase physical, hydraulic and energetic efficiency in a water supply system (Comisión Nacional del Agua, 2012). In this paper, three categories to achieve full efficiency arise: i) engineering production and distribution, which is divided into water quality, physical, hydraulic and energetic efficiency; ii) marketing service, divided into billing, receipts, accounting, user registry, estimated consumption, prices, etc., and iii) institutional development, which includes organized autonomy, leadership, personnel management, financial counseling, among others. The model includes the operating side of the water service, its marketing and administration but its approach focuses on specific business activities which support tactics that implement strategies.

Another way to evaluate effectiveness is with the Water Advisory Council's model (Consejo Consultivo del Agua, 2011), designed for the Mexican context in 2010. For its design, questionnaires were sent to water organizations in 50 cities in Mexico, in which important information was requested to represent the selected dimensions.

Five essential dimensions of the model were defined: the first is efficiency, it is considered in any operational aspects; the second is public finances, which is the income and expenses of an organization; the third is service quality, it is related to continuity of water supply; the fourth is the environment, that points out wastewater treatment and the fifth is institutions, it incorporates administrative aspects (Consejo Consultivo del Agua, 2011). An instrument was also used to collect information from managers on the subject, but it was not indicated rigorous statistical validity and reliability.

2. Literature review

This section describes conceptualization of the term organizational effectiveness, organizational effectiveness models and organizational effectiveness models in the water sector.

2.1. Conceptualization of the term organizational effectiveness

The term organizational effectiveness has been defined by diversity of authors like Georgopoulos and Tannenbaum (1957) as an extension of an organization as a social system which provides certain resources and means to achieve their objectives. Price (1968) shows that the concept indicates the compliance degree with several goals. Lawles (1972) indicates that the term refers to the level of observed targets which have been achieved in an organization. Campbell (1977) says that effectiveness is achieved when an organization is effective. Bedeian (1984) conceptualized the term as achieving properly a set of activities.

Campbell (1990) defined the term as the evaluation of the results of an employee's job performance. Finally, Chou, Robert and Powell (1998) mention that effectiveness is the attainment obtained by correctly perform established activities.

The above definitions have in common the achievement of a set of activities within an organization. However, the conceptualizations of Georgopoulos and Tannenbaum (1957), Price (1968) and Lawles (1972) focus on achieving goals; while Campbell (1977, 1990) does not define deeply the term effectiveness and Bedeian (1984) and Chou et al. (1998) explain that, despite achieving a series of goals, they must be done properly. The most comprehensive definition for this research is the one proposed by Chou et al. (1998).

2.2. Organizational effectiveness models

Natural system model of Georgopoulos and Tannenbaum (1957)

This theoretical model initially proposed by Georgopoulos and Tannenbaum (1957) in the United States was developed to assess and describe the work in organizations. It is based on the idea that all organizations are involved in a number of basic problems that should be solved to have effectiveness. Another variant of the model is explained by Seashore (1983), who considers the model as an optimization system in relation to the environment, which has a connection for exchanging information and energy, this allows organizations to be considered in the theory of open systems.

This model sees an organization as an interrelated system capable of achieving specific goals that are committed to other required activities. Effectiveness implies the output of products or services to ensure continuity and adequate inputs to a system. The model focuses its attention on the following aspects of effectiveness: i) evaluating all attributes of an organization; ii) independent evaluation of each indicator of effectiveness; iii) different meaning of an indicator in different contexts, and iv) moderation between resulting variables and causal variables (Seashore, 1983).

One advantage suggested by Gibson, Ivancevich and Donnelly (1994) to this model is that it allows describing the internal and external behavior of organizations. Internally, it can be seen how and why people perform their individual tasks and group activities within an organization. Externally, transactions of an organization can be related to others from different organizations or institutions. However, the model is general and does not specify clearly the process to follow to have organizational effectiveness.

Goal model of Price (1968)

The model developed by Price (1968) in the United States explains that achieving defined goals or purposes in an organization constitute effectiveness. Members of an organization, in their different hierarchical levels, are responsible for performing an effective organization, so that each group is part of an evaluation of effectiveness.

This model defines goals as a technique or a way to evaluate effectiveness (Price, 1968). Hall (1980) suggests that the model considers as a criterion of effectiveness fulfilled goals in terms of results over time. Scott (2003) indicates that components have a decisive influence on the operations of organizations, such as shareholders, employees, customers, suppliers, vendors, government regulators, community leaders, and the media, which have a legitimate interest in the operations of an organization.

Price (1968) carried out 50 empirical studies to build an inventory of propositions on effectiveness of organizations which should include the following measures: i) productivity; ii) moral; iii) compliance; iv) adaptability, and v) institutionalization. One of the main advantages of the model is that it provides a way to measure effectiveness through some indicators, but it does not delve into the process to follow for an organization.

Time dimension model of Campbell (1977)

The model was developed in the United States by Campbell (1977) with the aim of analyzing the impact of directors and their behavior on the effectiveness of organizations over time because they can be effective in the short term but they could have little chance of surviving in a market in the future.

The model measures effectiveness in the short term, taking into account these dimensions: i) production; ii) quality; iii) efficiency; iv) flexibility, and v) satisfaction. In the medium term, it considers the following dimensions: i) competitiveness, and ii) development. Finally, it considers in the long term the survival of an organization over time (Campbell, 1977).

The model is innovative in considering the time factor in effectiveness but survival requires adaptation, which may involve predictable sequences of action (Cameron & Whetten, 1981).

Model of decision-making process of Seashore (1983)

Seashore (1983) designed the model of decision-making process in the United States and it is based on the development of different forms to use resources of observable and measurable information as systemic integrity and the achievement of goals. According to

this author, an effective organization is one that optimizes processes of production, storage, retrieval, distribution, interpretation and download of information. It also has physical and human facilities capable of monitoring the quality of the information and the use of it to solve problems in the short, medium and long term.

The advantage of the model is the incorporation of resources that increase effectiveness but it is not very clear on what process to follow to increase it.

Effectiveness model of Seashore and Yuchtman (1967)

This model developed by Seashore and Yuchtman (1967) in the United States describes the performance of organizations and related common patterns that are used to support the model elements. The empirical analysis that was done consisted in evaluating 76 performance variables in 75 insurance companies, finding 10 effectiveness dimensions: i) volume or size of business; ii) production costs, iii) productivity; iv) age of employees; v) mixture of businesses; vi) development of human potential; vii) management emphasis; viii) maintenance costs; ix) productivity, and x) market penetration.

The model stands out for the range of dimensions that integrates, but it has been criticized by Goodman et al. (1983) because of the type of people who should take the dimensions, exclusion of economic factors and variability in the dimensions over time.

Effectiveness model of Mahoney (1967)

This model of Mahoney (1967) focused on searching criteria of effectiveness in organizations in the United States. The author's research included 84 directors of 13 companies who answered an instrument. In the first stage, 114 initial dimensions were obtained and with factor analysis they were reduced to 23 dimensions that take aspects of planning, organizational design and process control. In the second stage, Mahoney and Weitzel (1969) obtained dimensions of organizational effectiveness, productivity, support, planning, reliability and initiative.

The model considers a number of dimensions that have been verified statistically but it has been criticized by Goodman et al. (1983) for not revealing the complexity of relationships between dimensions and judgments of effectiveness, as well as differences in correlations between general organizations and research and development organizations.

Effectiveness model of Khandwalla (1973)

Khandwalla (1973), in its model, examined in the United States the relationships between organizational design and income as an indicator of effectiveness in 79 manufacturing companies. The model integrates the reduction of the uncertainty amount of support groups, decentralization of authority, departmentalization, management control and the level of management participation. Income was measured by averaging the highest and lowest corporate income before taxes during the previous 5 years. It was found that any of the variables of organizational design was related to income, most design variables were positively interconnected.

Unfortunately, there is no solid foundation between income and effectiveness, as well as the variability of income based on the market supplied by the 79 companies. Moreover, it was not considered to include in the profitability dimensions such as capital, technology, labor, the environment and the market, among others.

Effectiveness model of Cameron (1978)

Cameron's model, developed in the United States in 1978, emerged from an investigation in which there were interviewed university officials to discuss organizational effectiveness in institutions. For this, subjective and satisfaction judgments focused on students, academics and administrators were evaluated. Cameron set 9 dimensions of effectiveness from an intuitive perspective, resulting from interviews with senior managers, which deal with educational issues of student satisfaction, related to their academic and professional development (Cameron, 1978).

The model has been criticized because of the generalization to other educational institutions because universities are not unitary systems, they are formed by schools, departments and

other units, where each person generates different products, with different organizational forms and different types of objectives (Goodman et al., 1983).

2.3. Organizational effectiveness models in the water sector

Effectiveness model of Baietti, Kingdom and Ginnekenm (2006)

Baietti et al. (2006) conducted a study in the United States to define the main features that should have a water management organization. To achieve this, information was obtained from a combination of different sources in literature, consultations with experts from the World Bank and WaterAid and studies in 11 water companies from Poland, Vietnam, Mexico, Brazil, Singapore, etc.

The dimensions authors found for an organization to be effective are the following: i) external autonomy, it refers to the degree of independence from external interference; ii) external accountability, it has to do with the fulfillment of relevant functions by external stakeholders such as formulation of policies for the water service provision; iii) internal accountability, it is based on internal assessment of goal achievement in terms of resources to provide water services; iv) market orientation, it refers to the existence billing systems and receipt accessible to clients, and v) corporate culture, it is related to moral, social and behavioral standards that serve as inspiration for self-improvement in a water organization.

It is a model that encompasses many dimensions to evaluate effectiveness but the model limitations, according to Baietti et al. (2006), are the few variables, processes and mechanisms that affect performance because it is supposed that there are more but it is difficult to document them. For this reason, the research does not present a unified framework to improve performance of public services, but it identifies important factors.

Effectiveness model of the American Public Works Association et al. (2008)

A research done by the American Public Works Association et al. (2008) in the United States supported effectiveness in the water sector. The authors in their research identified ten attributes of effectiveness in the water for public managers to improve their performance.

The dimensions identified by the authors include: i) product quality, it is the compliance with regulations to obtain drinking water and its distribution to society; ii) customer satisfaction, it provides information meeting the needs of customers; iii) employee and leadership development, it refers to the worker's career opportunities and leadership development; iv) operational optimization, it has to do with the sustainable performance of work processes; v) financial viability, it maintains an effective balance of financial income and expenses; vi) infrastructure stability, it maintains and improves the condition of all long-term assets; vii) operational resiliency, it manages business risks; viii) community sustainability; it pays attention to the impact of decisions on society and watersheds; ix) water resource adequacy, it ensures constant availability of water with the needs of current and future customers, and x) stakeholder understanding and support, it provides understanding and support to monitoring organizations, the society and the interests of watersheds.

It is a comprehensive model for evaluating the internal and external part of a water organization, but the model does not provide sufficient empirical evidence of its application.

Effectiveness model of the OECD (2013)

Other research is given by the OECD (2013) in Mexico, in which the organization takes good practices developed in Coahuila, Colima, France, Wales, England, Italy and Portugal. The proposed dimensions that must be taken into by water organizations in order to be efficient are: i) institutional design, it involves a clear delineation of roles and responsibilities between water organizations and municipalities in Mexico to promote accountability; ii) organization and management, it refers to competency-based recruitment; iii) performance indicators for accountability; iv) user participation, and v) address the issue of financing to cover operating and maintenance costs.

The model takes international experiences of good practices in water, but the effectiveness cannot be generalized because it varies from one country to another depending on the

3. Methodology

This research is non-experimental in an exploratory, descriptive and transeccional design (Hernández, Fernández-Collado, & Baptista, 2014) because data was collected directly from reality where events occurred, without manipulating or controlling them. It is exploratory because effectiveness in drinking water has not been explored in depth by the scientific community from an administrative point of view with the approach of the most cited authors in the subject. It is descriptive because a critical review of organizational effectiveness was made, which started from a research of models of organizational effectiveness that contributed to the description and characterization of this phenomenon, from the view of authors widely cited by the scientific community as Georgopoulos and Tannenbaum (1957), Seashore and Yuchtman (1967), Goodman, Atkin and Schoorman (1983), among others.

It was also collected information from directors of water in Mexico City with the application of an instrument designed to evaluate organizational effectiveness, and from technical documents as the General Development program for the Development of the Federal District 2013-2018 and the Integrated Water Resources Management Program, 20-year vision, among others (Sistema de Aguas de la Ciudad de México, 2012a; Administración Pública del Gobierno del Distrito Federal, 2013).

The categories of analysis used for studying organizational effectiveness were taken from Campbell (1977) for his contribution to the field of contemporary organizational effectiveness based on an approach of interaction with multiple entities, in the elements of the goal model (Price, 1968) and the general systems theory (Von Bertalanffy, 1950).

3.1. Design of an instrument to measure organizational effectiveness in the water sector

It was discussed in literature that the way to measure organizational effectiveness is with information such as goods and services produced within a certain time, inputs used, costs and benefits of administrative processes, among others. However, due to difficulties in getting certain information about water management in Mexico City, it was chosen to develop an instrument with a Likert scale of 5 points, with response options ranging from strongly disagree to strongly agree, from the water context in Mexico City (Sistema de Aguas de la Ciudad de México, 2010, Comisión Nacional del Agua, 2014) taking the dimensions of organizational effectiveness of the model of Campbell (1977), but adapted to drinking water. This model was chosen because the author made contributions to the field of contemporary organizational effectiveness with a focus on multidimensional interaction, and because the dimensions of the model are possible to be adapted to the Mexican context.

The process to follow for the instrument designed involved the formulation of items for each dimension of the Campbell's model (1977). Initially, it had 5 dimensions with 54 items, with the instrument reduction, once applied to the directors, 4 dimensions with 15 items were obtained. For the reduction process, it was first verified that the data gets close to a normal distribution using skewness and kurtosis in the range of -1 to +1 (Fabrigar, Wegener, MacCallum, & Strahan, 1999). To determine the reliability of the instrument, items with Cronbach's alpha (Cronbach, 1951) were removed, each dimension has a value of at least 0.7, the same for the full scale, with 4 dimensions, which was 0.850 (Nunnally, 1967; Hair, Black, Babin, & Anderson, 2009). For validity, exploratory factor analysis with principal components, varimax rotation and eigenvalues of 1 was ran, which showed a 0.526 KMO and Bartlett's Test of Sphericity produced an approximate Chi-Square of 253.375 (df 105) with $p < 0.000$. The factor loadings were greater than 0.4 for the one-dimensionality of the 4 factors or dimensions which represent how much a factor explains a variable (Kaiser, 1960; Kaiser, 1974). It was corroborated the exploratory validity but it was not possible to run a confirmatory factor analysis with structural equation modeling to corroborate robust validity because it is necessary to have a size of more than 200 (Bentler & Yuan, 1999), and in this research there was a size of 16. Table 1 shows the results in which it can be seen that

almost all factors have 4 items.

Table 1
Exploratory factor analysis

Item	Statement	Factor loadings			
		1	2	3	4
Satisfaction3	Staff turnover is minimal	0.959			
Satisfaction4	Employees are far from punctual	0.947			
Satisfaction2	Minimal complaints are received from employees	0.925			
Satisfaction1	The needs of employees are satisfied	0.874			
Quality3	There is the necessary infrastructure to supply high quality drinking water		0.898		
Quality2	Regulations are applied to ensure high quality drinking water		0.894		
Quality1	High quality drinking water is received by the borough		0.799		
Quality4	Citizens receive high quality drinking water at home		0.761		
Efficiency4	Drinking water losses in distribution systems are minimal			0.881	
Efficiency3	Drinking water supply is done in the shortest possible time			0.878	
Efficiency1	The drinking water supply is done at the lowest possible cost			0.862	
Efficiency2	Profits outweigh the costs of drinking water supply			0.803	
Flexibility1	There is absence of time flexibility for supplying drinking water				0.952
Flexibility2	There is absence of cost flexibility for supplying drinking water				0.940
Flexibility3	There is absence of flexibility in drinking water losses in distribution systems				0.931
Percentage of variance explained		25.147	22.086	21.173	19.399
Cronbach's alpha		0.963	0.902	0.896	0.949

3.2. Sample size determination

A non-random sample and an expert sampling were used (Hernandez et al, 2014.) because there are 16 directors of Mexico City involved in managing drinking water in each of their boroughs: Álvaro Obregón, Azcapotzalco, Benito Juárez, Coyoacán, Cuajimalpa, Cuauhtémoc, Gustavo A. Madero, Iztacalco, Iztapalapa, Magdalena Contreras, Miguel Hidalgo, Milpa Alta, Tláhuac, Tlalpan, Venustiano Carranza and Xochimilco (Sistema de Aguas de la Ciudad de México, 2010).

4. Results

Organizational effectiveness models described in this research are the main located in literature by authors widely quoted on the subject. All models were developed in the American context, mainly in companies. It is worth mentioning that the models evaluate organizational effectiveness quantitatively from information such as the time it takes an organization to produce certain products over time.

The Georgopoulos and Tannenbaum's (1957) model needs to be clearer in defining goals, Seashore (1983) incorporates various forms to use information resources, but they lack clarity. Seashore and Yuchtman (1967) in their model do not incorporate economic factors versus time. In addition, Mahoney (1967) explains aspects of planning, organizational design and process control but it is unclear statistical development between general organizations and research and development organizations. Khandwalla (1973) focused on manufacturing firms, its organizational structure, while Cameron (1978) specialized in educational institutions. One of the most comprehensive models is the one of Campbell (1977) to identify dimensions that can occur in any organization, such as production, quality, efficiency, flexibility and satisfaction. The author incorporates some elements of the Price's (1968) model related to productivity and efficiency.

Further analysis is shown in Table 2, in which it can be seen a quantitative approach to measure effectiveness.

Table 2
Analysis of organizational effectiveness models

Model	Source	Context	Strategy
Natural system model	Georgopoulos and Tannenbaum (1957)	Basic problems in American organizations	Compliance with a number of goals in interrelated systems
Goal	Price (1968)	Overall evaluation of American organizations from 50 empirical studies	Compliance with goals over time
Time dimension	Campbell (1977)	Survival factors of American organizations over time	Administration impact on the effectiveness of directors over time
Decision-making process	Seashore (1983)	Analysis of American organizations	Diversity of forms to use information resources
Effectiveness	Seashore and Yuchtman (1967)	Evaluation of effectiveness variables in 75 insurance companies in the United States	Common patterns of performance in organizations

Effectiveness	Mahoney (1967)	Effectiveness criteria in 13 American companies	Effectiveness criteria of planning, designing organizations and controlling processes
Effectiveness	Khandwalla (1973)	Effectiveness in 79 manufacturing firms of the United States	Relations between organizational design and income
Effectiveness	Cameron (1978)	Analysis of effectiveness in educational institutions in the United States	Subjective criteria and satisfaction judgments focused on students, academics and managers

Source: own elaboration.

Organizational effectiveness models focused on the water sector are scarce in literature, but in table 3 it can be observed which were located. Note that effectiveness has not only been used in the private sector, but also in the public, where water management plays an important role, with good results (Coulter, 1979; Blunt, 1990; Provan & Milward, 2001; Heinrich, 2002; Parhizgari & Gilbert, 2004).

No full investigation analyzes organizational effectiveness in the drinking water management sector, with the administrative approach proposed by the authors founded in this topic. However, there are studies that address issues related to effectiveness as efficiency, efficacy and productivity. The models shown in Table 3 are some of these, which are characterized by retake, most of them, factors developed by some countries that represent best practices for organizations in order to have effectiveness. Models retake a lot of administrative dimensions like organizational design, recruitment, finance and corporate culture.

Table 3
Analysis of models of organizational effectiveness in the water sector

Model	Source	Context	Strategy
Effectiveness	Baietti et al. (2006)	Evaluation of characteristics of efficiency in 11 water organizations from Poland, Vietnam, Mexico, Brazil, Singapore, among others	Characteristics of organizational design, accountability, market orientation and corporate culture
Effectiveness	American Public Works Association et al. (2008)	Effectiveness in the water sector of organizations in the United States	Focus on internal administrative issues and communication with external actors
Effectiveness	OECD (2013)	Good practices water organizations in Mexico from experiences of Colima, France, Wales, England, Italy and Portugal	Definition of roles and responsibilities, accountability, recruitment, participation and financing

Source: own elaboration.

The range of scores obtained with the application of the instrument of organizational effectiveness, to the 16 directors responsible for drinking water management in each borough of Mexico City, from dividing the value of the range of scores obtained in each

dimension divided by the number of categories, then this value was subtracted from the maximum score value that can be obtained in that dimension. This procedure was performed for each dimension, and they were given a punctuation according to the scale of 5 points: excellent, good, fair, poor and very poor. This same procedure was also performed to calculate the total score by borough (see Table 4).

Table 4
Analysis of responses by borough

Borough	Flexibility	Efficiency	Quality	Satisfaction	Overall rating
Álvaro Obregón	Good	Poor	Excellent	Excellent	Good
Azcapotzalco	Fair	Good	Excellent	Excellent	Fair (almost good)
Benito Juárez	Fair	Excellent	Excellent	Very poor	Good
Coyoacán	Fair	Poor	Good	Fair	Good (almost fair)
Cuajimalpa	Excellent	Good	Excellent	Good	Good
Cuauhtémoc	Good	Good	Good	Poor	Good
Gustavo A. Madero	Excellent	Good	Excellent	Fair	Good
Iztacalco	Fair	Excellent	Excellent	Excellent	Good
Iztapalapa	Fair	Excellent	Good	Good	Fair
Magdalena Contreras	Good	Excellent	Excellent	Good	Good
Miguel Hidalgo	Excellent	Excellent	Excellent	Excellent	Excellent
Milpa Alta	Good	Excellent	Good	Good	Fair (almost good)
Tláhuac	Excellent	Excellent	Good	Good	Good
Tlalpan	Fair	Poor	Excellent	Good	Fair
Venustiano Carranza	Fair	Good	Excellent	Good	Fair
Xochimilco	Good	Good	Fair	Very poor	Fair
Overall rating	Fair	Good	Good	Good	

Source: own elaboration with IBM SPSS program V. 22.

As shown in Table 4, in general, a good grade in the dimensions efficiency, quality and satisfaction was obtained by each of the 16 boroughs of Mexico City. In particular, it is necessary to pay more attention to the following boroughs: Tlalpan, Venustiano Carranza, Xochimilco, Azcapotzalco and Iztapalapa, because they present problems in the dimensions

evaluated.

Complementary to the information analyzed, in efficiency and quality, according to the General Development program for the Development of the Federal District 2013-2018, in some areas of Mexico City there was insufficient water supply, discontinuous and without the quality required. From the total flow supplied to the city, 41% comes from water withdrawals from groundwater of the aquifer of the Valley of Mexico that causes overexploitation and a deficit of 23% in recharge which causes land subsidence affecting urban infrastructure. Furthermore, water supply is not homogeneous; for example, Iztapalapa residents receive 200 liters per day, while some areas of the west of the city receive more than 350. This is because about 1,500, 000 inhabitants are supplied by turns and 180,000 do not have networks that enable the installation of domestic outlet, because people are settle in forbidden land. Additional losses of 35% of water supplied due to leaks in the network, clandestine flows and unaccounted flows that prevent a good water supply. Similarly, water quality must be checked according to chlorine readings of the Water System of Mexico City because some samples in Iztapalapa, Tláhuac, Milpa Alta, Xochimilco, Azcapotzalco and Venustiano Carranza met between 95% and 82% of the requirements to have water quality (Administración Pública del Gobierno del Distrito Federal, 2013; Dirección Técnica del SACMEX, 2012; Sistema de Aguas de la Ciudad de México, 2012a).

To be able to make changes to the water system, it is necessary to have coordination among agencies involved in water management like the Government of Mexico City, the Water System of Mexico City and the 16 boroughs of the city. To make this possible, it is required that regulations introduced in the Water Law of the Federal District be met and there must be better proration of resources to solve trouble in the water sector.

To increase efficiency, it is recommended, especially in the boroughs that had low score, to analyze alternative water sources to complement the current offer by the Cutzamala system and the Lerma system. Studies have been conducted in various basins near the Valley of Mexico for this. According to the Water System of Mexico City (Sistema de Aguas de la Ciudad de México, 2012a), the following studied options require updating to determine their technical, economic and social feasibility, to ensure water supply in the medium and long term: Tecolutla, Amacuzac and the Mezquital Valley (Tula river). Furthermore, in the case of the Mezquital Valley, in the Basin of Tula River in Hidalgo, there is a feasibility study that indicates that the aquifer has enough availability of water to take safely an average rate of 7 m³/s, caused by aquifer recharge. Another possible source of supply could be Madin Dam, in which it could be possible to extracted about 0.5 m³/s and 1.0 m³/s, or Guadalupe dam, whose extraction is estimated at 1.5 m³/s (Sistema de Aguas de la Ciudad de México, 2012b).

It is important to stand out that the boroughs of Mexico City should continue with the emergency program to supply drinking water through water tank trucks. If new sources of water were found and new infrastructure to supply water had been had in Mexico City, the emergency program should be discontinued over time to avoid costs, and this program should be replaced by an efficient water supply system. It should be made a hydraulic plan of Mexico City; update related programs, do research to improve infrastructure related to drinking water supply and to keep track of each activity carried out according to the regulations to improve quality.

The flexibility of the effectiveness dimension causes the directors do not comply strictly with the time of delivering drinking water to people, so it is necessary to implement a program to prevent misuse of the water service, and implementation of penalties and fines, which should include monitoring water intakes or discharges, supervision of contracted services, application of sanctions and attention to non-conformities must be paid. There should be a process of competency-based recruitment and appointment terms that do not coincide with political cycles to ensure the capacity of water management organizations and avoid conflicts of interest with regulated entities. It is important to have qualified human resources constantly updated in order to increase the effectiveness of their work and their satisfaction through a prosperous career.

5. Conclusions

Organizational effectiveness in the drinking water sector, is a variable that hasn't been considered enough in the scientific literature, and the effectiveness models found focus more on the operational side of water resources. Similarly, there was not an instrument designed with a Likert scale to measure the phenomenon. The results showed that organizational effectiveness in drinking water is a construct composed of 4 dimensions, the dimension i) flexibility is focused on the ability to adapt to internal and external changes in order to ensure the survival of an organization by controlling time, costs and losses of drinking water; ii) efficiency, showed the relationship between inputs and outcomes considering the profitability of the drinking water organization, lost time, the cost per product and the loss of drinking water; iii) quality, visualized standards of excellence such as infrastructure needed to supply quality drinking water, regulations to ensure quality, the reception of quality water by a borough and the citizens it supplies, and organizational effectiveness in the drinking water sector, is a variable that hasn't been considered enough in the scientific literature, and the effectiveness models found focus more on the operational side of water resources. Similarly, there was not an instrument designed with a Likert scale to measure the phenomenon. The results showed that organizational effectiveness in drinking water is a construct composed of 4 dimensions, the dimension i) flexibility is focused on the ability to adapt to internal and external changes in order to ensure the survival of an organization by controlling time, costs and losses of drinking water; ii) efficiency, showed the relationship between inputs and outcomes considering the profitability of the drinking water organization, lost time, the cost per product and the loss of drinking water; iii) quality, visualized standards of excellence such as infrastructure needed to supply quality drinking water, regulations to ensure quality, the reception of quality water by a borough and the citizens it supplies, and iv) satisfaction, showed the degree to which an organization meets the needs of its employees, it also showed the decline in turnover, lack of punctuality and complaints. In particular, for improving organizational effectiveness in Mexico City it is suggested strengthening collaboration between different levels of government and interacting entities, drinking water organizations should implement improvement programs in each dimension of the construct and comply with current regulations. Of particular interest are the boroughs that were worst evaluated: Tlalpan, Venustiano Carranza, Xochimilco, Azcapotzalco and Iztapalapa. The issue of water effectiveness is multifactorial, so it requires multiple efforts of various organizations to solve trouble, not short term but long term. The research only sets the pattern to further researches on the subject.

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Revista ESPACIOS. ISSN 0798 1015
Vol. 39 (Nº 45) Year 2018

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