DOI: 10.24850/j-tyca-2025-04-06

Articles

Community water management model in Toluca: A tactical and integrated approach

Modelo de gestión comunitaria de agua en Toluca: una aproximación táctica e integrada

Edgar Anzurez-Valencia[1], ORCID: https://orcid.org/0000-0003-0511-2573

Alejandro Tonatiuh Romero-Contreras[2], ORCID: https://orcid.org/0000-0003-0444-1113

Carlos Díaz-Delgado[3], ORCID: https://orcid.org/0000-0001-6245-070X

Aracely Rojas-López[4], ORCID: https://orcid.org/0000-0002-5246-9703

[1]Secretaría de Ciencia, Humanidades, Tecnología e Innovación, Centro de Investigación en Alimentación y Desarrollo, A.C., State of Colima, México, edgar.anzurez@secihti.mx

[2]Instituto Interamericano de Tecnología y Ciencias del Agua, Universidad Autónoma del Estado de México, State of Mexico, Mexico, atromeroc@uaemex.mx

[3]Instituto Interamericano de Tecnología y Ciencias del Agua, Universidad Autónoma del Estado de México, State of Mexico, Mexico, cdiazd@uaemex.mx

[4]Universidad Intercultural del Estado de México, State of México, México, aracely.rojas@uiem.edu.mx

Corresponding author: Edgar Anzurez, eanzurezv@yahoo.com

Abstract

This work proposes a community water management model to solve in an integrated way the priority problems (economic, technical-operational and sociopolitical) suffered by the drinking water supply committees —ethnic origin— of the municipality of Toluca. This article employed with documentary research and desk analysis based on the theoretical approaches of governance, socio-historical, common goods, community management and integrated water resources management; were also considered the results obtained with the participatory strategic planning methodology with an integrated approach (52 key indicators) and the empirical evidence of field and participatory work (Anzurez-Valencia, Romero-Contreras, & Díaz-Delgado, 2025). The result was a hybrid model of community water management in accordance with the specific characteristics of Toluca and the priority needs of its original communities (historical, cultural, social, political, administrative and regulatory), accompanied by collaborative governance strategies (associativity), options for obtain legal recognition, and regulatory instruments (manual, regulation, guide). The model serves the actors that provide water services and implement public policies, so that they understand the community procedure, functioning, social organization, context, vision of water. It was concluded that the General Assembly of the Town is the

fundamental element to guarantee the success of the model, its importance and value is not limited to decision making in the communities, but to its operation through active participation, continuous commitment, trust, the will to change and community consensus.

Keywords: socio-historical approach, collaborative governance, drinking water committee, associativity, General Assembly of the Town, legal recognition.

Resumen

El presente trabajo propone un modelo de gestión comunitaria de agua que ayude a resolver de forma integrada los problemas prioritarios (económicos, técnico-operativos y sociopolíticos) que padecen los comités de agua potable —de origen antiguo— del municipio de Toluca. Este artículo se realizó con investigación documental y análisis de gabinete fundado en los enfoques teóricos de gobernanza, socio-histórico, bienes comunes, gestión comunitaria, cogestión y gestión integrada de los recursos hídricos; también se consideraron los indicadores clave obtenidos por Anzurez-Valencia, Romero-Contreras, & Díaz-Delgado (2025) a través de la metodología de planeación estratégica participativa con enfoque integrado, y la evidencia empírica de trabajo de campo y participativo. Resultó un modelo híbrido de gestión comunitaria de agua acorde con las características específicas de Toluca y las necesidades prioritarias de sus comunidades originarias (históricas, culturales, sociales, políticas, administrativas y normativas), acompañado de estrategias de gobernanza colaborativa (asociatividad), opciones para obtener el reconocimiento legal e instrumentos normativos (manual,

reglamento, guía). El modelo sirve a los actores que prestan servicios de agua e instrumentan políticas públicas, para que entiendan el proceder comunitario, funcionamiento, organización social, contexto, visión del agua. Se concluyó que la Asamblea General del Pueblo es el elemento fundamental para garantizar el éxito del modelo, pues su importancia y valor no se limita a la toma de decisiones en las comunidades, sino a su funcionamiento a través de la participación activa, el compromiso continuo, la confianza, la voluntad de cambio y el consenso comunitario.

Palabras clave: enfoque socio-histórico, gobernanza colaborativa, comité de agua potable, asociatividad, Asamblea General del Pueblo, reconocimiento legal.

Received: 20/03/2024

Accepted: 05/06/2024

Available ahead of print: 19/06/2024

Version of record: 01/07/2025

Introduction

The water crisis facing today's societies in Mexico and other Latin American countries is worrying. The problems of water scarcity, management, distribution and sanitation are part of the difficulties, but several authors argue that this implies a crisis of governance, not just of governability, which mainly affects vulnerable areas -poor and marginalized neighborhoods- of rural, peri-urban and urban areas, where

drinking water supply committees operate (Martínez & Reyna, 2012; Domínguez, 2012b).

This crisis of governance focuses on the lack of legal and institutional conditions to encourage and include the participation of all actors and sectors providing water services at the different levels of society. At the local and community levels, traditional forms of organization -non-governmental- that manage and distribute water services stand out, as is the case with drinking water supply committees -of ancient origin- that operate under informal rules through water self-management and governance.

In the last two decades of the last century, the Mexican Government undertook legal and institutional changes in the provision of water and sanitation services, giving technical, administrative and financial autonomy to the municipalities, which today, for the most part, have become dependent on funding and have failed to build institutional capacity to manage these services efficiently and effectively (Domínguez & Castillo, 2018: 479).

These neoliberal and technocratic legal and institutional changes, on the one hand, promoted the decentralization, commercialization and exploitation of water resources in the hands of private capital, municipalities and operating agencies. While, on the other hand, they ignored and excluded community organizations in the provision of the water service, because, from their perspective, they do not meet the criteria of efficiency, equity, quality and financial sustainability of the drinking water service.

These water reforms and institutional changes have disregarded the potential and cultural autonomy of drinking water supply committees and their native communities -historically inhabited by ethnic groups with Mesoamerican characteristics- who since 1930 have not ceased to provide water service through their own rules and legitimacy, based on identity, self-management, community assembly, governance, civic-religious system of charges, social organization and customary law, which are as valid and remain in force as an official system (Aguilar, 2011; Becerril, Romero, & Rodríguez, 2020: 53).

Despite the omissions and ambiguities of the legal framework, coupled with the lack of interest of neoliberal governments to recognize and include the participation of community committees in water normativity, several authors document that this type of traditional social management can be key to increasing water coverage in the communities of origin and achieving the sustainability of their systems (Domínguez & Castillo, 2018; García, 2015).

For the above, the aim of this work is to propose an integrated tactical model of community water management in Toluca, which will help to solve the key problems and the legal, organizational and functional strengthening of the 27 drinking water supply committees of Toluca (DWSCT). These DWSCT —of ancient origin— are widespread in 19 communities originating in Toluca (16 committees operate in urban areas; 8, in conurbated areas; and 3, in rural areas), which supply almost half a million inhabitants and makes them social structures of great influence for the territoriality of the municipality's water governance.

This work is supported by the theoretical approaches of governance, sociohistorical, community management, common goods and integrated

water resources management (IWRM), complemented by field work (interviews with key informants) and participatory work (empirical evidence), where the potential and cultural autonomy of community organizations for collaborative governance and governability are emphasized. It is also supported by the 52 key priority indicators of the DWSCT management system, obtained by Anzurez-Valencia *et al*. (2025: 39-42) through the participatory strategic planning methodology with an integrated approach (PSP-IWRM methodology), with which they identified, analyzed and prioritized the water problem of DWSCT.

In this way, a hybrid model of community water management in Toluca is proposed according to the specific characteristics of the municipality (social, historical, cultural, political, normative), but, above all, in accordance with the priority problems suffered by the 27 DWSCT and their communities of origin. It is also supported by strategies (procedure for obtaining legal recognition, associativity, collaborative governance) and normative instruments (manual, regulation, guide) for solving key problems and improving and strengthening legal, organizational and functional.

The particular utility of the model serves the actors-groups of interest who are responsible for instrumenting public policies in the area of water and sanitation (legislators, deputies, councillors, municipal presidents, directors), to deepen their knowledge of the Community process, context, vision of water, as well as its functioning and social organization. It also serves DWSCT and their communities to understand and compare their management, identify differences and similarities with regard to the model, and informedly choose, within and within the General Assembly of the community, the direction and adjustments of

governance, resulting in the basis for the design of a tactical plan of action —explicitly targeted and measurable— that guides alternative solutions.

The General Community's Assembly is undoubtedly the key element in ensuring the success of the model, and its importance and value is not limited to decision-making, but to its functioning through active participation, continuous commitment, confidence, willingness to change and collective consensus in communities.

The structure of this article is as follows. First, the introductory framework and the socio-historical description of the study site are presented. Secondly, come the theoretical approaches that served as the basis for the analysis and interpretation of data and information. Thirdly, the methodology to be followed to the overall objective is presented. Fourthly, results come where governance and governability strategies are identified and defined, as well as the proposed integrated tactical model. Fifthly, the discussion of the results is presented, and finally the conclusions.

Socio-historical description of the study site

The municipality of Toluca, founded in the year 640 AD by the Matlazincas, belongs to the macro-cultural area defined as Mesoamerica and is demarcated by other multi-ethnic municipalities that also have a high presence of indigenous communities (Otomites, Mazahuas, Nahuas, Tlahuicas, Matlatzincas) and peasant populations of ancient origin, which present a traditional social organization to control and manage the water resource based on usages and customs (Hinojosa, 2014) (Figure 1).

Tecnología y Ciencias del Agua

OPEN ACCESS

Check for updates

Figure 1. Geographical location of the municipality of Toluca in the State of Mexico. Source: Authors' elaboration based on Anzurez-Valencia (2020: 95).

The earliest backgrounds related to the drinking water service in Toluca date back to the 17th century, with the construction of an aqueduct that supplied water to the Franciscan convent of the Assumption. The spread and consolidation of the farms during the colonial system, the 17th and 18th centuries, produced raw materials and manufacturing products to meet the demand of the capital of the viceroyalty. The ancient Toluca was so sparsely populated that it took more than two hundred years to build new works that would improve the drinking water service (Estrada, 2003).

At the end of the 19th century, within the framework of the movement of "Hygienism" spread internationally, the municipality of Toluca had to adapt to the conditions of modernity and public sanitation in the water supply, so that, between 1889 and 1893, the municipal cabinet carried out works of entubation, conduction and distribution of water, replacing the old canals and open pipes with steel pipes (Alvarado-Granados & Anzurez-Valencia, 2024).

In those years, 1880-1911, the federal government managed to centralize power and control the development of the country's economy, adding to its jurisdiction mining, commercial and water legislation. In this way, the municipalities began to be displaced and to see their autonomy limited, due to the increasing intervention of the federal and state government, which favoured foreigners, farmers and industrialists with the granting of concessions for the exploitation of water and forest resources (wood and coal), as well as other regional resources: labour, empty land, electricity, accessibility (Silva, 1999; Camacho, 1998).

From 1953, the Lerma system aqueduct began the extraction and conducting of waters from the springs and lagoons that gave rise to the River Lerma to supply water to Mexico City, which caused the ecological deterioration of the Toluca valley: decline in the freatic level, loss of springs, extinction of nories, desiccation of lakes and wetlands. Due to these losses, starting in 1966 and in the 1970s, the municipal government began to over-exploit the Toluca Valley aquifer, increasing well drilling as well as the number of drinking water supply committees, as the wells were left in the hands of the communities. In the same year, 1966, the construction of the second stage of the Lerma system began and with it the drilling of more wells (156 piezometric wells and 188 exploitation wells) in the aquifers of Toluca and Ixtlahuaca, which caused imbalances and impacts on nature, peasant homes and agricultural economy (Camacho, 1998: 278; Silva, 1999: 62).

During the last eighty years, the municipality of Toluca has presented a phenomenon of metropolisation and an important economic development in the industrial, commercial and services sectors, increasing the drilling of wells and the construction of huge hydraulic works for the water supply of the cities of Mexico and Toluca: the Lerma system (1951) and the Cutzamala system (1982), which coincided with the establishment of the industrial corridor Toluca-Lerma (1940) whose greatest growth occurred in the years 1960-1970 (Alvarado-Granados & Anzurez-Valencia, 2024).

The dispersed and disorderly urbanization process, coupled with Toluca's population growth, complicated the drinking water management model, which is distributed through two management systems: the municipal and the community. The first, the Toluca Drinking Water Supply

Operating Agency (TDWSOA), officially serves 75 % of the municipal population, equivalent to 682,956 inhabitants —calculated from INEGI data (INEGI, 2020)— with the operation of 92 deep wells interconnected to the distribution network, 6 pipes, and block water from the Cutzamala system. The second, the DWSCT, do not have accurate information about the population served, nor are there official data on the part of the public authorities, however, Campuzano (2015) by means of field work, estimated that the DWSCT supply more than 50 % of the total population with the operation of 34 wells, springs, venues, pipes, and a branch of the Lerma system (Campuzano, 2015).

The above information on the population served by each management system is inaccurate, as in Toluca there are vulnerable areas in urban, urban and rural areas that lack the service or do not have the entubated water of the public network, due to the difficult access for the construction of the network because they are located in places of high risk. Also, there are delegations with combined water services between the TDWSOA and the DWSCT, such as Calixtlahuaca, Tlachaloya, San Pablo Autopan, San Andrés Cuexcontitlán, Santa Ana Tlapaltitlán, San Mateo Oxtotitlán, San Lorenzo Tepaltitlán, San Felipe Tlalmimilolpan, Santa Maria Totoltepec.

The DWSCT provide the drinking water service independently with little or no collaboration with the public authorities: the National Water Commission (NWC), Water Commission of the State of Mexico (WCSM), TDWSOA, the City of Toluca (directorate and municipality with water commission); who by law (LAN, 2016; LAEMyM, 2013) are in charge of the public management of water resources. These lack of co-management, negotiation and agreements have caused distrust, conflicts

and rivalry between both management systems (TDWSOA vs DWSCT), because they do not work in the same way as provided for by law, duplicate functions, confuse responsibilities, but, above all, because the DWSCT have their own exploitation rights, have no legal basis or contribute to the municipal administration.

Currently, the provision of the drinking water service in the municipality of Toluca by both management systems TDWSOA and DWSCT, is inefficient and insufficient with limited management capacities (technical, operational, administrative, financial), which causes low quality of the service (low hydrostatic pressure, water leaks, inadequate distribution), coverage problems, lack of transparency, a lack of sanitation of wastewater and lack of maintenance of the hydraulic infrastructure.

Socio-historical approach to the interpretation of Community water management

Thomas Samuel Kuhn's model of scientific dynamics (Kuhn, 2006) and Max Weber's concept of "Ideal Type" (Aguilar, 1989), introduced the historical and social (cultural) approach as a methodological procedure for analysing, understanding and solving complex problems of social phenomena.

Kuhn (2006) demonstrated that scientific development is marked by profound changes in theories, practices, objectives, procedural norms and evaluation criteria, which are extraordinary –revolutionary– episodes where a change occurs in the practice and understanding of science. Kuhn developed his proposal for a scientific revolution based on the history of science. It demonstrated that scientific development to investigate

problems was based on a priori fundamental ideas, which are socio-historical proposals implicit in models involving taxonomies that incorporate tacit knowledge. In other words, Kuhn demonstrated with outstanding examples -paradigms- how to rely on them, to find solutions to problems that one did not know how to attack, and to solve many others by similar ways in a coherent manner.

The Weber Model (Ideal Type) is one of the most famous contributions to his idea of the scientific method, where he states that historical science is not possible without the conceptual ordering of reality, and without the relationship with cultural ideas, through which reality gains meaning, thus becoming a historical fact and, therefore, an object of historiographic knowledge (Aguilar, 1989).

The term "Ideal Type", according to Weber, has the meaning of a purely ideal boundary concept, with respect to which social reality is measured and compared to clarify certain significant elements of its empirical content. The ideal type establishes the relationship that exists between reason and history, consciousness (science) and society, abstract and concrete (Aguilar, 1989; Sánchez-de-Puerta, 2006).

This Ideal Type is formed by the unidimensional emphasis of one or more points of view, and by the synthesis of a large number of concrete phenomena, individual, diffuse, distinct, present or sometimes absent, which are placed according to those points of views emphasized unilaterally in a unified analytical construction (Sánchez-de-Puerta, 2006). This construction brings together certain processes and causal relations of historical life (historical data). It is of great use for the empirical research of social change in complex organizations, and works as a heuristic apparatus intended to be used in the study of portions of

historical reality, to compare it, to establish divergences or similarities, and to understand, understand and explain causally the social world (Ritzer, 1993).

The socio-historical approach of Weber and Kuhn serves the present study to improve knowledge of the DWSCT management system, and facilitate the analysis and understanding of certain processes and relationships (cause-effect), which are fundamental to identify essential features of the social and cultural reality of DWSCT, and to make rational, real and coherent proposals with their sociological and historical context.

Theoretical approach to water governance and IWRM

In the water sector of countries like Mexico, the concept of governance is used to distinguish it from governability. The discussion focuses on the sociopolitical relevance of the concept. Both terms describe the sociopolitical system, its components and the way in which conflicts are processed. These are two interrelated concepts, but with different origins, definitions and meanings. The concept of governability presupposes a normative framework and is associated with concepts of order, stability, effectiveness and political legitimacy based on democracy, but governability does not necessarily refer to democratic values and practices, because democratic governance will be given only when decision-making and conflict resolution is carried out in accordance with a system of rules and formulas that can be qualified as democratic (Aguilar, 2010; Sánchez, 2012: 224; Martínez & Reyna, 2012: 22).

For its part, the concept of governance means a new style of government, different from the old hierarchical control model, in which

authorities (government) exercise sovereign power over citizens. Governance is characterized by a greater degree of cooperation and interaction between the State, independent stakeholders (social, political, public, private) and networks between organizations (formal and informal). In this way, governance is associated with the concepts of co-direction, interaction and co-management and, in some cases, of conduct between political and social actors (Aguilar, 2010; Sánchez, 2012: 258).

However, the concept of water governance has been built around two main ideas: 1) in the analysis of the role of the actors so that they have participation-inclusion in decision-making, and 2) in the changes in the institutions to facilitate that involvement-inclusive; i.e., in the government's role, in the modification and establishment of the "rules of the game" and in the various forms of water management (Domínguez, 2012a: 16; Martínez & Reyna, 2012; OCDE, 2011; Domínguez, 2007).

The concept of water governance refers to processes and interactions between social, economic, political, environmental and government systems, which are in a position to develop and manage water resources, and distribute water services at different levels of society, to their co-responsible management and a joint vision on the use and future of water resources and to implement mechanisms that facilitate their achievement (Colmex, Conagua, IMTA, & ANEAS, 2012: 4).

Also, water governance has been formed around the IWRM, to point out that the water crisis in today's societies is not simply a problem of scarcity or management, but a crisis of governance (Domínguez, 2012a; Domíguez, 2007, p. 5). This crisis must be seen as an opportunity to innovate and take new decisions that lead to beneficial and positive course of action, which encourages and involves the participation of all

governmental and non-governmental actors, in order to foster governance based on various partnerships, thereby achieving better governance (Lerner, Uvalle, & Moreno, 2012: 11 y 13).

Thus, water governance with a IWRM focused approach is an effective form of management, which is used with a broad and integrated vision of mechanisms to improve the use, conservation and distribution of the resource in a sustainable way. Governance within the GIRH scheme provides key elements (equity, efficiency and sustainability) for achieving a balance in participation and decision-making, which places it as an indispensable prerequisite for the proper development and implementation of IWRM programmes (Domínguez, 2012a: 11; Domínguez, 2012b: 256).

At the global level, IWRM projects are highlighted in which the inclusion of society in decision-making and action development has been promoted through participatory processes, such as the analysis and recognition of the traditional forms of management carried out by indigenous communities (common goods), based on experience and harmonious coexistence with nature (Ostrom, 2000; Domínguez, 2007: 8). To reach this point, effective government participation in decision-making within the GIRH scheme, and recognition of sociocultural contexts are required to generate new legal frameworks.

In addition to institutional capacity, governance includes other important elements in decision-making, such as the distribution of resources, processes and behaviours that influence the exercise of power and that is nothing more than the inclusion of all social actors, who decide under other "informal" rules, even outside the law or the GIRH model (Domínguez, 2007: 5).

Tecnología y Ciencias del Agua
OPEN ACCESS
Check for updates

The practical problem of water governance depends on a range of social, political, cultural, environmental and economic circumstances, so it is a problem of consensus, of how to reach agreement, transactions and decision-making between the various actors, who are involved with their own resources, opposing interests, different organizational capacities, different levels of knowledge and different approaches. It is also a problem of how to exercise power over citizens to manage water resources and ensure equitable provision of services (Domínguez, 2007: 8; Aguilar, 2010: 65).

Thus, the key elements that contribute to the achievement of governance in GIRH, understood as the effective model for conserving and using water in a sustainable way, are: responsibility, social participation, institutional framework, democracy, cooperation (incorporating vulnerable groups), voluntariness, equity, interdependence, self-management, identity, integrity, transparency and accountability (Domínguez, 2007: 8; Domínguez, 2012a: 17; Domínguez, 2012b: 256; Romero *et al*., 2015; García & Herrera, 2019: 3).

Community water management models in Mexico and Latin America

In several countries around the world, and specifically in Latin America, there are various methodologies and models to support community water management, especially in poor and marginalized neighborhoods in urban, peri-urban and rural areas.

In the analysis and bibliographic review, various studies carried out by the World Bank through its Water and Sanitation Programme (WSP),

the International Department of British Government (DFID) and the NGO CARE, the International Centre for Water & Sanitation, the World Health Organization, among others are highlighted (Ampuero, Faysse, & Quiroz, 2005; Aguilar, 2011).

The World Bank Water and Sanitation Programme sets out a comprehensive framework for community water management based on experiences in nine Latin American countries: Bolivia, Chile, Colombia, Guatemala, Ecuador, El Salvador, Honduras, Nicaragua and Peru. This is based on a sample of 32 small-scale local operators (LOPEs) operating in rural, peri-urban and urban areas, which are public, private or mixed operators providing water service to poor populations, ranging from tank trucks or tankers (Private LOPES), to community-based LOPES organizations or associations (water and sanitation networks) of various kinds, called councils or committees that predominate in the rural area (Aguilar, 2011: 21).

OLPE experiences in the Andean and Central American countries have shown that their operation is closer to small private enterprises with commercial criteria and almost zero social content. Some of the characteristics of OLPES are: they have financial resources for international cooperation, municipal governments and local operators; most of their water sources are private; they appear to have the technical capacity to cope with operational problems; they have consumption measurement; they are not responsible for sanitation and the treatment of served waters is incipient (Aguilar, 2011: 26).

However, access to drinking water service through OLPEs is determined by the income levels of the population: with higher income levels, better quality and access to service (24 hours); while the majority

of the low-income population (the poorest), get a poor quality service and less amount of water, because they are not connected to the public network and are supplied intermittently by tank trucks, or extract water directly from rivers and other contaminated sources (Aguilar, 2011: 27). The following are other reference models:

1. For the specific case of Mexico, Silva (2014), from the concept of public management, proposed a community water management model based on five international models (water of Honduras; common property management of Ostrom; PROPILAS of Peru; model of Paraguay; community development and institutional strengthening of Bolivia), from which he identified key elements for integrating a general model in Mexico. This study, firstly, recommends the incorporation of community water management into article 115 of the Political Constitution of the Mexican United States (PCMUS), and to reform articles 15, 20, and 112 BIS of the National Waters Act (2012), to regulate community management in Mexico. It then recommends changes in the organizational, administrative, commercial, financial and operational structure of Community water management. Finally, it proposes the coordination of the model with the three levels of government, and the implementation of a long-term strategic planning process (Silva, 2014). The Silva model (Silva, 2014) is general and considers similar community water management in urban, suburban and rural areas in Mexico and Latin American countries. However, consideration should be given to the cultural pluralism in northern, central and southern Mexico, the socio-historical characteristics of community management, the complexity of water problems and the

specific needs of drinking water supply committees per hydrosocial basin.

2. Bernal, Rivas and Peña (2014) proposed a co-management model for rural drinking water supply committees in Colombia involving a plural number of actors from different sectors for collaborative management (national, regional or departmental and local-municipal/community). This model is community-centred, highlighting their potential, community empowerment, cooperation and collective action for local development. The Bernal-Rivas-Peña co-management model, adjusted and aligned with the legal framework of Colombia, is based on the possibility of coordinated and cooperative action between the different levels of government, intermediate actors (private sector, civil society, NGOs) and communities to support community management. It also encourages participation and vertical and horizontal relationships through operational rules, which are the result of consensus, allocating the budget, human talent and negotiation spaces necessary for community participation. The Bernal-Rivas-Peña model can be applied in Colombia, but it is difficult to replicate or adapt to the case of Mexico, mainly because of the political and normative differences in each federative entity, where in some cases they have accepted and legislated for water committees, while in other states they promote their disappearance.

3. Kreimann (2013) carried out a comparative analysis of social water management by rural and peri-urban drinking water supply committees in Nicaragua. This study is approached from the theoretical perspective of the management of a common good,

where the advantages and disadvantages of collective management are analysed and explained in the geographical context (rural and peri-urban) in which these committees are located.

The previous proposals for Community water management models affirm similar management features and raise general changes in the organizational and functional structures of the committees. They also adapt parts of other models from the international context and adapt them to the local context, considering a uniform community management with similar problems in the various countries and regions.

According to Escobar (2015), the outcome that turns out to be the best option for community water management and collaborative governance, is to create a "hybrid organization" in accordance with the reality of the specific socio-political context, that is flexible and adaptable to new situations in constant change, but without intending to apply unique formulas that can be replicable or generalizable to a different or much wider context (Escobar, 2015).

These characteristics that are sought for hybrid organizations can be found in planning processes, in which case the authors have called it "colaborative planning". From this concept the inquiry about a particular situation begins and the best solution is sought with the participation of all involved (government at its three levels and the self-organized community) by gaining strengthening of this instance of coordination, resilience and robustness in the actions to be implemented (Escobar, 2015: 44).

Tecnología y Ciencias del Agua

OPEN ACCESS

Check for updates

Methodology

The community water management model was built with documentary research and cabinet analysis from the bibliographic review of various studies (theses, scientific articles, books), based on theoretical approaches of governance, socio-historical, community management, common goods, co-management and IWRM. These approaches analyze, discuss and recognize the potential of communities as self-organized communities, as well as the cultural autonomy of drinking water supply committees for collaborative governance and water governability.

Also, the model was built on the results found by Anzurez-Valencia *et al*. (2025) through the PSP-IWRM methodology (participative strategic planning with an integrated water resource management approach), with which they identified, analyzed and prioritized the socio-political, economic, environmental and technical-operational problems affected by the 27 DWSCT. With this PSP-IWRM methodology, *52 key priority indicators* were also identified (Anzurez-Valencia *et al*., 2025: 39-42) which, in the present study, were considered and addressed for the identification of strategies and alternative solutions, which accompany and complement the proposed model.

Thus, the present study is theoretically and methodologically linked to previous researches (Gómez, Romero, & Vizcarra, 2017; Campuzano, 2019; Anzurez-Valencia *et al*., 2025) and postgraduate theses developed at the Inter-American Institute of Water Technology and Sciences (IITCA-UAEMex) by Campuzano (2015), Anzurez-Valencia (2016), Gómez (2016) and Anzurez-Valencia (2020), which were based on empirical evidence of field work (interviews with key informants) and participatory-incidence

work with community actors (municipal delegate, citizen committee, mayomordia, eighth commissariat, drinking water committe, irrigation committees, social control), hard conducted during the development of these researches (2013-2019) about social organization, water governance, PSP and IWRM.

Therefore, the present study no longer required further research of field work, but used the data and information already validated and discussed in previous studies and research, which served as a basis for the conceptualization and interpretation of theoretical-conceptual information, as well as in the identification of actions and alternatives of solution.

In this way, the proposal for the model was carried out in a methodical and analytical manner through systemic processes in accordance with the specific characteristics of Toluca and its communities of origin, but, above all, without ignoring the public authorities that provide water and sanitation services according to the current legislation on water.

Results

Twelve solution strategies were identified based on the 52 key indicators found with the PSP-IWRM methodology by Anzurez-Valencia *et al*. (2025: 39-42), where they identified, analyzed and prioritized the problems (sociopolitical, economic, environmental and technical-operational) that DWSCT suffer –of ancient origin– with an integrated approach. In the Planning and Coordination Strategic Areas (PCSA) 4 governance strategies were identified and defined, where 24 key indicators are

involved; in the technical-operational PCSA 5 strategies, where 19 key indicator is involved; and in the socio-political PCSA 3 strategies where 9 key indicators are involved (Anzurez-Valencia *et al*., 2025: 50) (Table 1).

Table 1. Governance Strategies by PCSA

PCSA	Strategies	Key indicators involved
Economic (24 key indicators)	1. Provide financial incentives to committee actors in order to better performance of their functions.	54, 34
	2. Develop the internal statutes of the committee to establish and specify functions, rules, penalties and penalties.	58, 60, 38, 39
	3. Promote and strengthen transparency and accountability to improve citizen participation and decision-making	41, 46, 32, 36, 45, 47, 42, 31, 50, 44, 37
	4. Encourage and promote the payment of water (pointed, anticipated, in kind) among users through refunds, condonations, discounts, labour, to improve the financial situation of the committee.	57, 48, 53, 43, 35, 56, 55
Technical-operational (19 key indicators)	1. Encourage and promote counselling and comprehensive training of committee actors to improve the operation, maintenance and rehabilitation of hydraulic infrastructure.	107, 104, 106, 109, 93, 100, 110
	2. Generate and update reliable and accurate committee data and information to improve citizen monitoring and decision-making.	114, 116, 102, 120
	3. Establish appropriate tariffs that meet technical and operational criteria and costs of maintenance, rehabilitation and expansion of the hydraulic infrastructure.	94, 103, 113, 119
	4. Promote the equity in the supply and distribution of water services, in order to guarantee the human right to water.	98
	5. To disseminate on a continuous basis information on the water situation of the Committee, in order to reduce misinformation and improve decision-making.	112, 111, 117
Sociopolitics (9 key indicators)	1. Manage and grant water concessions for domestic and urban public use, following procedures and priorities in accordance with constitutional and water regulations.	19, 11, 17
	2. Promote the collaborative governance with other actors (historic, social, governmental, civil society, academics, NGOs) to interdisciplinary and intersectoral work.	23, 30, 11
	3. Recognize, protect and respect the cultural autonomy of committees and their historical communities in the provision of water services, in order to fulfil the human right to water.	15, 27, 5, 30

Source: Authors' elaboration based on Anzurez-Valencia *et al*. (2025: 45-50).

Tecnología y Ciencias del Agua
OPEN ACCESS
Check for updates

These twelve governance strategies are mandatory for the Integrated Tactical Model of Community Water Management in Toluca (ITMCWMT), which, through its structure, functions, PCSA and normative instruments, is responsible for implementing and monitoring indicators for the solution of key-priority problems (Figure 2).

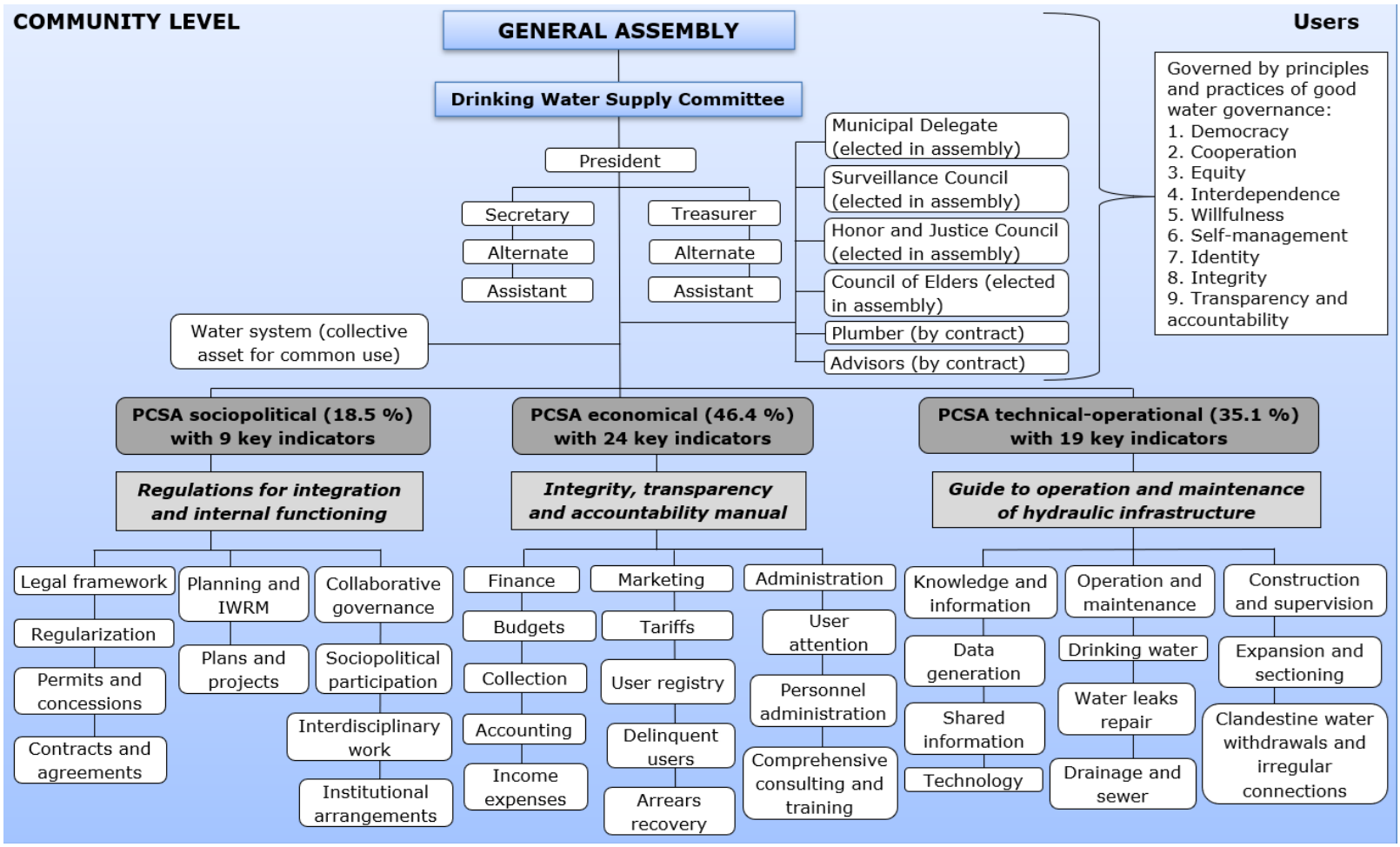

Figure 2. Organizational and functional structure of ITMCWMT. Source: Authors' elaboration based on Anzurez-Valencia (2020).

The General Community's Assembly is the governing body (the highest Community authority) responsible for the direction and administration of ITMCWMT. The ownership is constituted by the drinking water supply committee, and downward powers are delegated to its members, almost always present: president, secretary, treasurer, alternates, vocals and poacher.

The General Assembly of the Community is the most important participatory democratic institution at Community level, it is constituted by the participation of all indigenous inhabitants recognized by the same community through community identity, where all and everyone has the right to attend, opinion, discuss, ratify and approve decisions. The decisions of the General People's Assembly are binding on the committee and the community.

The most important functions of the General Community's Assembly in the field of water management and management are the following:

- Analysing, discussing and approving actions and alternatives to resolve problems submitted by the committee to its consideration, which are not within its competence to decide;
- Informing, transparency and accountability to users about the administrative, technical and financial situation of the Committee: works, collection, water intakes, payments to users;
- Choosing and appointing by collective consensus the representatives of the committees;
- Developing the normative instruments (internal regulations, manual on transparency, accounts, guidelines for the operation and

maintenance of the hydraulic infrastructure), which govern the community and the Committee must monitor and enforce.

The drinking water supply committee must be a legal person with its own property, whose highest authority is the General Community's Assembly, composed of the voluntary participation of all users and officers of the committee. This must be legally supported to access programs and support from the government, research centres, NGOs, community associations (Latin American Confederation of Community Organizations of Water Services and Sanitation: LCCOWSS), to collaborate in the solution of the socio-water problem of Toluca.

The most important functions of the drinking water supply committee are as follows:

- Convocate and preside over General Assemblies;
- Implement and enforce the decisions derived from the general assemblies,
- Take care of and manage the economic resources of the community efficiently;
- Submit annually to the Assembly, the management of financial resources, general report of activities, work plans, collection fees, compliance with the payment of users (cash cuts);
- Operate, distribute and maintain in good condition the hydraulic infrastructure: leak repair, adequate installation of home outlets, correct segmentation of the distribution networks.

Citing Bernal *et al*. (2014: 174), the listing of more or less functions in the rules of procedure of the drinking water supply committee will enable

the organization, management and improvement of the conditions of water systems in the community, but will not guarantee the success of ITMCWMT. Rather, as Escobar (2015), requires the active participation of users, the continued commitment of representatives, and thus the smooth functioning of the General Assembly of the Community.

It should be noted that the identification and definition of the functions of the committee, should obey and meet the solutions strategies, above proposed, and the key indicators that were detected in the analysis and prioritization of the problem of the DWSCT (Anzurez-Valencia *et al*., 2025).

With regard to the legal support of the committee, a collaborative governance procedure was identified and defined to gradually obtain legal personality and official recognition of DWSCT before the State.

Process 1. **Voluntary community change**. This process arises in the community from the voluntary decision to change the same users and commissioners of the committee, to be legally recognised and accepted before the State. The participation, interest and initiative of the community through the General People's Assembly is essential to improving their water systems. However, if there is the will or interest in change, the following steps of this procedure are continued. However, later on, the interest and political decision of the municipal government will be required to recognize, protect and defend the cultural legitimacy of the DWSCT.

Process 2. Toluca Municipal union intercommittees of drinking water of Toluca. This process consists of expanding the territoriality of the DWSCT in partnership or associativity, to cohesive their collective

social action and contribute jointly to the governance and governability of the water in the municipality of Toluca.

This partnership allows to establish agreements and agreements of collaboration between DWSCT and other stakeholders (government, political parties, research centres, social, NGOs, civil society), to exchange and communicate experiences, transfer and share information, obtain funds and material resources, create economies of scale, increase and strengthen capacities (technical, administrative, legal, financial), have a collective presence, the legal recognition and cultural autonomy of DWSCT (Aguilar, 2011: 35; García, 2015; Domínguez & Castillo, 2018).

This associativity is feasible in the 19 delegations originating from Toluca, where the 27 DWSCT are located, most of which are contiguous in rural, peri-urban and urban areas, share similar characteristics (identity, self-management, customs and customs, civic-religious system of charges), and are essentially related in their long-term social and historical systems, which allows them to relate and establish collaborative agreements to jointly address the socio-water problem in their communities.

Process 3. Express recognition and effective inclusion of the committees in the municipal government of Toluca. The municipal government is responsible for the provision of drinking water, sewerage and sanitation services, in accordance with article 115 of PCMUS (2014), the municipal organic law and the various water laws and regulations. This actor is responsible for regulating relations between the TDWSOA vs DWSCT to improve water coverage in the municipality of Toluca.

Similarly, the municipal government must recognize and include the participation of DWSCT, alone or in association, in the municipal governance and development plans, to drive coordinated work with the TDWSOA, train DWSCT actors, strengthen community management, and in the medium term, their effective incorporation into the state water planning and programming.

Therefore, the municipal government must open up governance to other actors other than the public and private sectors, to recognize, protect and respect the self-management and cultural autonomy of the DWSCT and their communities of origin.

Process 4. Express recognition and effective inclusion of committees in constitutional and water legislation. Reforms and legal changes to constitutional and water legislation have favored, on the one hand, the public and private sectors, where urban populations, operating agencies, industry, trade, services and enterprises are located. While, on the other hand, they have neglected the vulnerable areas (poor and marginalized neighborhoods) of rural and urban areas, where the peasant and indigenous populations and their drinking water supply committees are located, based on self-management, governance and customary law.

However, the Mexican State must gradually legislate from the bottom together with the committees, in order to effectively include them in the PCMUS and in national, state and municipal water legislation. This inclusion involves reviewing and implementing the legal and financial adjustments specifically applied to committees, in order to promote their cultural development and strengthen their historical rights to water.

It is therefore considered to revise the following legal listings, which serve as a legal basis for the committees and their long-standing historical communities.

- Articles 2 (fractions V and VII), 4 (sixth paragraph), 39 and 115 (fraction III) of the PCUMS (2014).
- Articles 5 (fractions II and III), 14, 20, 48 and 112 of the LAN (2016), and articles 18 and 29 of its Rules of Procedure.
- Articles 3, 6 (fraction XLI), and 68 of the LAEMyM (2013).

Similarly, the following two options should be considered:

1. The production of a water law that guarantees the human right to water in Mexico, such as the Citizen Initiative of General Water Law (CIGWL) proposed by Ovando & Hernández (2020: 93), which covers the social, historical, cultural, geopolitical, economic and (plural) legal characteristics of Mexico, where the active role of community self-governing systems is recognized and claimed, they are endowed with legal personality and they are empowered to participate in the planned co-management of hydrosocial basins.
2. The organization and functioning of the drinking water supply committee as a civil association that establishes the LAN (2016) in an ambiguous and limited manner, which will involve knowing the terms, powers, rights and obligations that must be respected and fulfilled in accordance with the Federal Law on the promotion of activities carried out by civil society organizations (LFFAOSC, 2004).

These options should be reviewed and analysed in accordance with the local or regional context, to determine where regularization of committees is possible and where not. What is not admissible is to impose a single

option and to force by decree the diversity of types of existing committees, violating their original rights on water.

Collaborative ITMCWMT Governance

The ITMCWMT, alone or in partnership, can establish relations of collaborative governance and articulation of functions with other stakeholders-groups of interest (government, political, social, historical, research centres, NGOs, civil society, LCCOWSS) of the different levels of government (community, local, state, national and international) related to the provision of water and sanitation services (Table 2).

Table 2. Collaborative ITMCWMT Governance.

Level	Skateholders-interest groups	Regulation
International	World Bank, International Monetary Fund, World Health Organization	Global policies
National	NWC, PROFEPA, IMTA, Technical advice, Water Advisory Council	Political Constitution of the United Mexican States. National Water Law and its regulations
State	Water Secretariat, WCSM, River basin organizations (councils, commissions, basin committees), State Water Advisory Council, User committees, COTAS, IITCA-UAEMéx	Political Constitution of the free and sovereign state of Mexico, Water law of the state of Mexico and municipalities, and its regulations.
Municipal	City Council, TDWSOA	Organic Municipal Law of the State of Mexico, Municipal side.
Community	Municipal delegation, stewardship, ejidal commission, drinking water supply committee, irrigation committee, surveillance council, council of honor and justice, council of elders.	General assembly of the people, internal regulations, customs and traditions, civic-religious position system.

Source: Authors' elaboration based on Bernal *et al*. (2014).

Collaborative governance as a new way of governing establishes vertical and horizontal relationships of cooperation among actors and institutions at different levels of government. Vertical relationships arise when a higher government authority, under a formal legal criterion, orders or conditions the decisions of a lower authority. Horizontal cooperation relationships arise when different instances of a level of government, under a consensus, decide to act together and harmoniously, through collective decision-making rules and operational rules that allow for the development of self-regulation and self-management (Bernal *et al*., 2014: 176).

At the local and community level, the ITMCWMT establishes horizontal collaborative relationships with the municipal government and the TDWSOA, and also coordinates functions with other community support structures, such as the surveillance council, honor and justice committee, and council of elders, which have fundamental functions: 1) to promote and strengthen transparency and accountability in the community; 2) to oversee and sanction the administrative functions of the committee members; 3) to encourage citizen participation and enforce the agreements derived from the General Assemblies.

It is worth noting that the collaborative governance of ITMCWMT does not exclude local government; rather, it is coordinated and regulated through the principles of new municipal public management (transparency and accountability, integrity, technology, citizen participation), and governance practices that ensure and guide the functioning, organization, and decision-making capacities, such as:

democracy, cooperation, voluntariness, equity, interdependence, and self-management.

However, as Cadena & Morales (2020) point out, at the local level it should be considered that the presence of more actors, and the interactions among them, do not guarantee collaborative governance of the ITMCWMT, because the horizontal relationship between the municipal government, the TDWSOA, and the DWSCT is limited or nonexistent, due to the existing conflict and distrust.

Additionally, it is proposed that ITMCWMT receive support, guidance, and institutional backing from the government, through state or municipal links, to achieve capacity building and the sustainability of water systems (Aguilar, 2011: 40; Lockwood, 2002).

Five external links are suggested to address the needs of the 19 indigenous communities through frequent visits to each of them (once a month). These links will be employees of the state and municipal government (CAEM, TDWSOA), responsible for supporting, guiding, and providing information, advice, and comprehensive training to the DWSCT in matters of health, education, culture, environment, legal, financial, administrative, and technical-operational issues (Aguilar, 2011: 45).

Finally, the ITMCWMT must have **regulatory instruments** in each of the PCSA to establish and regulate functions through key indicators.

1. **Regulations for internal organization and operation**. It contains the internal statutes regarding the structure, organization, integration, functions, rights, and obligations of the members of the committee, General Assembly, auxiliary authorities, well driller, and users. It also includes penalties, fines, and sanctions for users' failure

to pay, breaches of integrity by the actors, irregular connections, and illegal water tapping.

2. **Manual on Transparency and Accountability**. It contains the regulations to promote and strengthen transparency, integrity, and accountability in the community; encourages voluntary participation in the Assemblies, so that stakeholders and users take responsibility for monitoring and decision-making; establishes a code of ethics and outlines preventive anti-corruption measures to reduce information opacity, resource diversion, impunity, complicity, theft, and scam.
3. **Operation and maintenance guide for hydraulic infrastructure**. It contains the technical procedures that guide the operation, distribution, maintenance, and rehabilitation of hydraulic infrastructure, such as: connecting household connections, repairing leaks, installing valves, and sectioning drinking water distribution networks.

These normative instruments will be established in the Community's General Assembly through common analysis and discussion among the users and members of the committee, in accordance with local circumstances and the decisions historically made by the community regarding their water systems.

Once these normative instruments are current and approved by the General Assembly, the same users must respect, comply with, and adhere to them, subject to the imposition of sanctions and penalties, whether cultural, moral, or legal.

Discussion

In this work, various studies, research, methodologies, and models supporting community water management were identified and reviewed, which propose a general management framework based on homogeneous criteria across several countries, particularly in Latin America (Ampuero *et al*., 2005; Aguilar, 2011). Such experiences affirm that community water organizations exhibit a similar organization and functioning, with uniform characteristics and similar problems.

Based on these approaches, some authors identified key elements of international models to integrate and adapt them to general models, recommending changes in the organizational, administrative, commercial, financial, and operational structure of community organizations (Kreimann, 2013; Bernal *et al*., 2014; Silva, 2014). These proposals did not take into account cultural plurality, specific characteristics, and the complexity of water issues by hydrosocial basin.

On the contrary, other authors agreed that the selection and proposal of a community water management model must align with the historical, cultural, sociopolitical, economic, and regulatory conditions, but above all, it should address the specific problems associated with each region. This means that there should not be unique formulas or universal replicable schemes to address the plurality of problems faced by community organizations. Rather, they should be aimed at outlining solution alternatives that take into account local specificities: power relations, culture, history, knowledge, and management capacity (Lerner *et al*., 2012: 12; Colmex *et al*., 2012; Aguilar, 2011; Escobar, 2015: 44).

This work proposes a model that takes into account the specific characteristics of Toluca and its indigenous communities (identity, civic-religious charge system, structure, organization, functioning), but above all, it addressed the priority issues faced by the DWSCT, which they have resolved through customary law, self-management, and water governance.

Likewise, the twelve solution strategies were in line with the social, cultural, historical, political, and regulatory reality of the DWSCT, and were fundamentally based on: 1) the 52 key indicators obtained using the PSP-IWRM methodology (Díaz-Delgado *et al*., 2009; Anzurez-Valencia *et al*., 2025); 2) the analysis and interpretation of the theoretical-methodological framework, and 3) the empirical evidence from fieldwork (interviews with key informants) and participatory work in a committee.

Within the organizational and functional structure of the model, it was identified that the General Assembly of the Community is the essential element that plays a key role in the decision-making process, both regarding water issues and other general matters of the community, such as public works, church, school, cemetery, roads, and public services. The General Assembly is the most important democratic institution for participation where decision-making power is unified and exercised; its determinations are respected and mandatory for the committee and the community. This Assembly can be presided over by the committee members, but it cannot be decided by them alone; it must be determined by the community according to local circumstances and the historical experience of water.

The main issues regarding water that are analyzed, discussed, and approved in the General Assemblies are as follows: election of committee

members; functions (administrative, operational, and technical); administration period (one to three years); establishment of rates; payment period (annual, semi-annual, monthly); payment methods (monetary, labor, in kind); distribution and provision of service (scheduled supply); exemptions, discounts, waivers (for individuals with physical vulnerabilities, health issues, the elderly, poverty); accountability (financial reports), cooperations, public works.

Citing Escobar (2015: 299): It states that the Assembly is a fundamental factor for community life, collaborative governance, and the self-management of water committees. The author points out that the Assembly is strong and functional when user participation is sufficient in the community, but when participation is scarce, the functioning of the Assembly and the management of the committee weakens.

According to Escobar (2015: 285-290), assemblies weaken mainly due to political issues that affect participation and social cohesion in communities. Some examples include the collection of political favors during campaign times; the distribution of food packages and financial support; government impositions; the involvement of party militants or supporters in the community; the opacity of information for political reasons (lack of notice or invitation to Assemblies); the shift to constitutional voting in electoral processes; the size of the locality and its proximity to the urban center (when a community grows, peolple prefer to pay rather tan participating in chores).

In this way, it was identified that the proposed model, actions, and alternative solutions can hardly be implemented without interest (will), participation, trust, commitment, and community consensus. These principles are built and shared within the community through the People's

General Assembly when decisions are analyzed, discussed, and approved to address water issues. However, these principles will also not be sufficient if there is no political will and decision from government actors to listen to them, recognize them, accept them, and effectively include them in water regulations.

In the same way, it was identified that the model must be legally supported by constitutional regulations and water laws to strengthen its cultural autonomy, improve its water systems, and assist in the development of viable and fair public policies. The procedure to obtain legal personality and official recognition before the State arises from the community level with the General Assembly of the Community, based on the collective decision of the users and members of the committee (commitment and consensus). It includes self-management, governance, customary law, and the voluntary nature of community change.

Thus, the municipal government of Toluca is the closest actor to the community, capable of recognizing, protecting, and defending self-management, governance, and the cultural autonomy of the DWSCT. This is viable because in some periods of administration they have recognized and promoted support, training, and coordinated work between the TDWSOA and the DWSCT. However, most of the previous municipal governments have ignored governance and the self-management potential of the DWSCT, considering that the TDWSOA is the only solution for providing water services efficiently and effectively.

In this regard, García (García, 2014: 20 and 23; García, 2015) points out that it is necessary to change the modernizing approach to development based on investment and the construction of hydraulic infrastructure, which does not address the needs of poor and marginalized

communities, and that these communities cannot sustain with their limited incomes. The change of focus refers to centering projects around people, in line with their culture, needs, economic capacity, and aspirations, without degrading ecosystems.

The explicit recognition of community management and its effective inclusion in regulations was considered an option to strengthen cultural autonomy and the capacities for community management. However, in Mexico, there are no legal conditions or institutional capacity to strengthen and protect this type of management. The reforms and adjustments to the regulations have focused on promoting the participation of the private sector and public organizations. These reforms and legal changes focus on issues of payment, costs, efficiencies, quality, and financial sustainability of water and sanitation services, which concern public agencies. However, despite these conditions, the committees have continued to provide water service in their communities through their own rules, regulations, and legitimacy, based on self-management, governance, and customary law, which are as valid as an official system (Aguilar, 2011; Becerril *et al*., 2020).

In this way, it was identified that the legal and institutional changes in Mexico do not correspond to the realities of the communities and indigenous peoples, as they do not formally recognize the cultural existence of the committees for the use and management of water. On one hand, national legislation recognizes committees as long as they are formed as Civil Associations (CA) to self-supply water and enter the tax regime of the nation's water property. Meanwhile, on the other hand, the legislation of the State of Mexico recognizes committees as organized groups of users, but excludes them from state water planning because

they do not meet the legal requirements like public and private actors for the provision of water services.

It was identified that water regulations in Mexico are extensive, complex, and contradictory regarding the attributions, responsibilities, interactions, and competencies among the different actors, sectors (social, public, private), organizations, and institutions at the three levels of government that provide water and sanitation services. For this reason, many rural systems operate informally, as they are unaware of and ignore the terms, conditions, obligations, rights, and limitations under which they operate (Domínguez & Castillo, 2018: 479).

In light of these ambiguities in the regulations, combined with the inadequate and insufficient technical-operational and financial capacity of local governments to provide water and sanitation services, the Citizen Initiative for the General Water Law (CIGWL) proposed by Ovando & Hernández (2020: 93) is supported. This CIGWL provides legal support, responsibilities, and public funding to community systems, but it is necessary to build grassroots organization, where training is fundamental and essential. The voices, knowledge, culture, and mobilizations of disadvantaged or excluded popular and indigenous sectors affected by the privatization of the resource are also necessary. The ultimate goal will be a national network of community water and sanitation systems, with multiple and democratic leaderships, that also operates permanently and collaborates in the construction of the new citizen-led watershed councils (Ovando & Hernández, 2020: 95).

In relation to this national network of community systems, it was identified that the associativity of DWSCT would strengthen community water management and unify social action with a regional approach. This

associativity, with the capacity for dialogue, would help to establish a collective presence with other stakeholders, to strengthen agreements and contracts, prevent unfavorable negotiations in water policy, establish collaborative relationships, and access technical, administrative, financial, and legal knowledge.

In this regard, García (2015), and Domínguez *et al*. (2018: 493) emphasize that associativity is key to strengthening community water organizations and the sustainability of their water systems. In addition to creating links with research centers and civil society organizations for collaborative governance and network development, associativity enables the fulfillment of the human right to water in vulnerable areas where the State does not reach.

Conclusions

In summary, an integrated model of community water management was proposed in Toluca, aligned with the specific characteristics of the indigenous communities (culture, history, rights, knowledge, willingness, commitment, trust) and the water-related issues faced by vulnerable areas in the rural, peri-urban, and urban zones of Toluca.

The model is based on the theoretical approaches of collaborative governance, socio-historical perspectives, community management, common goods, and IWRM; it was supported by empirical evidence from fieldwork and participatory work, and took into account the results obtained from the PSP-IWRM methodological process (key indicators). These inputs allowed for an improved understanding of the management system of the DWSCT, and to identify essential elements for making ad

hoc proposals (real, logical, pure, coherent), based on the sociocultural and historical reality.

Collaborative governance with a focus on IWRM is an effective management approach that involves actors from different sectors, utilizes a broad and integrative vision, and offers values, principles, and democratic practices that are fundamental to achieving a balance in participation, inclusion, and decision-making. Governance is an essential condition for achieving good development and implementation of IWRM, where local solutions take place and the recognition of traditional management practices carried out by indigenous communities occurs.

The Community's General Assembly is the fundamental element of the model that allows for the analysis, discussion, and approval of decisions; its proper functioning through active participation, ongoing commitment, trust, willingness to change, and community consensus will ensure the success of the model.

The proposed solutions in the model (legal recognition, regulatory instruments, associativity, collaborative governance, external links), supported by a tactical action plan –explicitly directed and measurable–, will help organize, manage, and improve the coverage of drinking water services in their communities. These alternative solutions help community actors understand and compare their management styles, establish differences and similarities, and make informed choices regarding the direction and adjustments of governance.

This work argues that the disappearance of committees is not the only solution to the problem of water service management, nor is their formation into civil associations as proposed by current legislation.

Rather, it is necessary to review the efforts made by research and citizen initiatives to improve or reform existing regulatory frameworks, which seek to harness the cultural potential of the committees and create the conditions to propose better governance and management of water, respecting collective consensus, the history of communities, and the water rights of their committees (the willfulness of changing the manner when they decide).

Acknowledgments

To the Research Program for Researchers of the Mexiquense Council of Science and Technology (COMECYT EDOMÉX) for the support provided for the establishment of a chair at the Faculty of Urban and Regional Planning of the Autonomous University of the State of Mexico.

References

Aguilar, L. (1989). *Weber: la idea de ciencia social. La innovación*. Volumen II. MCMXXXVIII. México, DF, México: Universidad Nacional Autónoma de México, Coordinación de Humanidades, Porrúa.

Aguilar, L. (2010). *Gobernanza: el nuevo proceso de gobernar*. Fundación Friedrich Naumann para la libertad, México. Recovered from http://red.sevalladolid.mx/pdf/20150713120009871783Aguilar%20Luis_Gobernar%20el%20nuevo%20preceso%20de%20gobernar.pdf

Aguilar, E. (2011). *Gestión comunitaria de los servicios de agua y saneamiento: su posible aplicación en México*. México, DF, México: Comisión Económica para América Latina y el Caribe. Recovered from http://repositorio.cepal.org/bitstream/handle/11362/26079/S2011150_es.pdf?sequence=1

Alvarado-Granados, A. R., & Anzurez-Valencia, E. (2024). Abasto de agua potable en el municipio de Toluca. Organismo operador y comités comunitarios. En: Pliego, E., Hernández, O. G., & González, V. (coords.). *Diálogo de saberes, experiencias y estudios del agua en México: diversidad, alternativas y perspectivas emergentes,* ISBN: 978-607-633-946-6 (pp. 377-400). Universidad Autónoma del Estado de México, Toluca, México. Recovered from http://hdl.handle.net/20.500.11799/141702

Ampuero, R., Faysse, N., & Quiroz, F. (2005) *Metodología de apoyo a comités de agua potable en zonas peri-urbanas. Diagnóstico integrado para el mejoramiento de la gestión y visión al futuro*. Cochabamba, Bolivia: Proyecto NEGOWAT, Centro AGUA-CERES. Recovered from http://agritrop.cirad.fr/559443/

Anzurez-Valencia, E. (2016). *Procesos de gobernanza en el municipio de Toluca. Comparación de la gestión del servicio de agua potable: organismo operador y comités comunitarios* (tesis de maestría). Centro Interamericano de Recursos del Agua, Toluca, México.

Anzurez-Valencia, E. (2020). *Diseño táctico integrado de un comité comunitario de agua para la gobernanza e integridad con enfoque de GIRH* (tesis de doctorado). Instituto Interamericano de Tecnología y Ciencias del Agua, Toluca, México.

Anzurez-Valencia, E., Romero-Contreras, A., & Díaz-Delgado, C. (2025). Análisis táctico integrado de la problemática de los comités de agua potable de Toluca. *Tecnología y ciencias del agua*, 16(2), 1-68. DOI: 10.24850/j-tyca-2025-02-01

Becerril, C. A., Romero, A. T., & Rodríguez, L. F. (2020). Gobernanza y pluralismo legal en la gestión agua potable: interacción de instituciones. En: Hernández, O. G., & Alvarado, A. R. (coords.). *Necesitamos una ley de aguas para garantizar el derecho humano en México* (pp. 41-55). México, DF, México: Universidad Autónoma del Estado de México. Recovered from http://hdl.handle.net/20.500.11799/108752

Bernal, A., Rivas, L., & Peña, P. (2014). Propuesta de un modelo de co-gestión para los pequeños abastos comunitarios de agua en Colombia. *Perfiles Latinoamericanos*, 22(43). DOI: 10.18504/pl2243-159-2014

Cadena, C., & Morales, M. (2020). Conflictos entre ayuntamiento y comités independientes en Toluca por la gobernanza del agua. *Carta Económica Regional*, (127), 25-53. DOI: 10.32870/cer.v0i127.7790

Camacho, G. (1998). Proyectos hidráulicos en las lagunas del Alto Lerma (1880-1942). En: Suárez-Cortez, B. E. (Coord.). *Historia de los usos del agua en México: oligarquías, empresas y ayuntamientos, 1840-1940* (pp. 229-280). México, DF, México: Comisión Nacional del Agua, Centro de Investigaciones y Estudios Superiores en Antropología Social, Instituto Mexicano de Tecnología del Agua.

Campuzano, J. (2015). *AEPA social en la GIRH conceptuación y jerarquización con análisis multicriterio: caso Toluca de Lerdo* (tesis de doctorado). Instituto Interamericano de Tecnología y Ciencias del Agua, Toluca, México.

Campuzano, J. (2019). Sistema de cargos y manejo de agua potable en los comités de Toluca de Lerdo. *Tecnología y ciencias del agua*, 10(1), 52-84. DOI: 10.24850/j-tyca-2019-01-03

CPEUM, Constitución Política de los Estados Unidos Mexicanos. (2014). *Últimas reformas publicada DOF 07-07-2014*. Recovered from https://www.diputados.gob.mx/LeyesBiblio/pdf/CPEUM.pdf

Colmex, Conagua, IMTA, & ANEAS, Colegio de México, Comisión Nacional del Agua, Instituto Mexicano de Tecnología del Agua, & Asociación Nacional de Entidades de Agua y Saneamiento de México. (2012). *Hacia un posicionamiento de gobernanza del agua en México. D.F., México*. Recovered from https://agua.org.mx/wp-content/uploads/2012/06/doc__gobernanza_del_agua-conaguacolmex.pdf

Díaz-Delgado, C., Esteller, M. V., Velasco-Chilpa, A., Martínez-Vilchis, J., Arriaga-Jordán, C. M., Vilchis-Francés, A., Manzano-Solís, L. R., Colín-Mercado, M., Miranda-Juárez, S., Uribe-Caballero, M. L. W., Peña-Hinojosa, A. (2009). Guía de planeación estratégica participativa para la gestión integrada de los recursos hídricos de la cuenca Lerma-Chapala-Santiago. Capítulo Estado de México. Toluca, México: Red Interinstitucional e Interdisciplinaria de Investigación y Coordinación Científica para la Recuperación de la Cuenca Lerma-Chapala-Santiago (Red Lerma), Universidad Autónoma del Estado de México. Recovered from https://www.researchgate.net/publication/277405521_Guia_de_Planeacion_Estrategica_Participativa_para_la_Gestion_Integrada_de_Recursos_Hidricos_de_la_Cuenca_Lerma-Chapala-Santiago_Capitulo_Estado_de_Mexico

Domínguez, J. (2007). La gobernanza del agua en México y el reto de la adaptación en zonas urbanas: el caso de la Ciudad de México. Centro de estudios demográficos, urbanos y ambientales, El Colegio de México. Recovered from https://biblio.colsan.edu.mx/arch/especi/Ag_eq_018.pdf

Domínguez, J. (2012a). Hacia una buena gobernanza para la gestión integrada de los recursos hídricos, documento de posicionamiento: meta 2.1. y 2.2. Proceso regional de las américas, VI foro mundial del agua. El Colegio de México. Recovered from https://www.gwp.org/globalassets/global/gwp-cam_files/gobernanza-para-girh-2012.pdf

Domínguez, J. (2012b). Gobernanza urbana del agua: los problemas por resolver en las ciudades latinoamericanas. En Murillo, D. (Coord.). *La gobernanza del agua: un desafío actual. Hacia una mirada crítica del concepto y de su aplicación* (pp. 255-296). Instituto Mexicano de Tecnología del Agua, Morelos, México.

Domínguez, J., & Castillo, E. (2018). Las organizaciones comunitarias del agua en el estado de Veracruz. Análisis a la luz de la experiencia latinoamericana. *Estudios demográficos y urbanos*, 33, 2(98), 469-503. DOI: 10.24201/edu.v33i2.1756

Escobar, C. (2015). *La asamblea comunitaria en Tlaxcala como eje de la gestión del agua: una experiencia de gobernanza colaborativa* (Tesis de doctorado). Facultad Latinoamericana de Ciencias Sociales, FLACSO-México. Recovered from https://flacso.repositorioinstitucional.mx/jspui/handle/1026/80

Estrada, J. (2003). *Introducción de agua y drenaje. El caso del Programa Seguimos en Acción de Toluca de Lerdo, 2000-2002* (tesis de maestría). El Colegio Mexiquense, Toluca, México.

García, M. (2014). De la apropiación de tecnología a la gestión del conocimiento. Retos en la gestión comunitaria del agua y el saneamiento. En: Romero, R., & Soares, D. (coords.) *Memorias: los retos de la adopción tecnológica en el sector hídrico de Latinoamérica* (pp. 11-24). Jiutepec, México: Instituto Mexicano de Tecnología del Agua. Recovered from https://www.researchgate.net/publication/303719161_Community_Management_of_Rural_Water_and_Associativism_in_Colombia_In_Spanish

García, M. (2015). Gestión comunitaria del agua rural y asociatividad en Colombia. En: Castro, J. E. (ed.) *Cuadernos de Trabajo de la RED WATERLAT-GOBACIT*, 2(11), Newcastle Upon Tyne, Reino Unido, y Santiago de Cali, Colombia. DOI: 10.13140/RG.2.1.2148.0561

García, M., & Herrera, F. (2019). La cuenca hidrosocial presa Huapango, México: un análisis de la gestión integrada de los recursos hídricos y la gobernanza en cuerpos de agua compartidos. *Agua y territorio*, 14, 69-84. DOI: 10.17561/at.14.4639

Gómez, B. (2016). *Género, mujer y agua: un análisis desde la gobernanza en los comités de agua potable de Toluca* (tesis de maestría). Instituto Interamericano de Tecnología y Ciencias del Agua, Toluca, México.

Gómez, B., Romero, A., & Vizcarra, I. (2017). Visibilización de la participación femenina en los comités comunitarios de agua potable de Toluca, Estado de México. *Sociedad y Ambiente*, (15), 67-92. DOI: 10.31840/sya.v0i15.1787

Hinojosa, A. (2014). *Estudio comparativo de gestión del agua entre el derecho consuetudinario y la ley en qanats* (tesis de doctorado). Instituto Interamericano de Tecnología y Ciencias del Agua, Toluca, México.

INEGI, Instituto Nacional de Estadística, Geografía e Informática. (2020). *Censo de Población y Vivienda*. Recovered from https://www.inegi.org.mx/app/areasgeograficas/?ag=15#collapse-Resumen

Kreimann, R. (2013). Los comités de agua potable y saneamiento y la gestión social de un bien común en Nicaragua. Los casos de los CAPS de El Edén y Chompipe. *Agua y Territorio*, 2. DOI: 10.17561/at.v1i2.1342

Kuhn, T. (2006). *La estructura de las revoluciones científicas* (The Structure of Scientific Revolutions) (3ª ed.). Colección Breviarios: 213. México, DF, México: Fondo de Cultura Económica.

LAN, Ley de Aguas Nacionales. (2016). *Última reforma publicada DOF 24-03-2016*. Recovered from https://www.diputados.gob.mx/LeyesBiblio/ref/lan/LAN_ref07_24mar16.pdf

LAEMyM, Ley del Agua para el Estado de México y Municipios. (2013). *Decreto número 52*. Recovered from https://legislacion.edomex.gob.mx/node/911

Lerner, B., Uvalle, R., & Moreno, R. (2012). *Gobernabilidad y gobernanza en los albores del siglo XXI y reflexiones sobre el México contemporáneo*. México, DF, México: Universidad Nacional Autónoma de México, Instituto de Investigaciones Sociales, Instituto de Administración Pública del Estado de México, A. C.

LFFAOSC, Ley Federal de Fomento a las Actividades Realizadas por Organizaciones de la Sociedad Civil. (2004). *Última reforma publicada DOF 24-04-2018*. Recovered from https://www.diputados.gob.mx/LeyesBiblio/pdf/LFFAOSC.pdf

Lockwood, H. (2002). *Mecanismos de apoyo institucional para los sistemas rurales de agua potable y saneamiento manejados por las comunidades en América Latina. Washington, EHP*. Recovered from https://es.ircwash.org/sites/default/files/Lockwood-2002-Mecanismos.pdf

Martínez, P., & Reyna, F. (2012). Gobernanza. Reflexiones desde la gestión pública. En: Murillo, D. (coord.). *La gobernanza del agua: un desafío actual. Hacia una mirada crítica del concepto y de su aplicación* (pp. 17-38). Jiutepec, México: Instituto Mexicano de Tecnología del Agua.

OCDE, Organización para la Cooperación y el Desarrollo Económico. (2011). *Water governance in OECD Countries: A multi-level approach, OECD Studies on Water*. DOI: 10.1787/9789264119284-en

Ostrom, E. (2000). *El gobierno de los bienes comunes: la evolución de las instituciones de acción colectiva*. México, DF, México: Fondo de Cultura Económica, Universidad Nacional Autónoma de México.

Ovando, J. R., & Hernández, O. G. (2020). Situación jurídica de los sistemas autogestivos comunitarios de agua en la actual Ley de Aguas Nacionales (LAN), en la llamada Ley Korenfeld (LK) y en la Iniciativa Ciudadana de Ley General de Aguas (ICLGA). En: Hernández, O. G., & Alvarado, A. R. (coords.). *Necesitamos una Ley de Aguas para garantizar el derecho humano en México*. Toluca, México: Universidad Autónoma del Estado de México. Recovered from http://hdl.handle.net/20.500.11799/108752

Ritzer, G. (1993). *Teoría sociológica clásica* (Classical sociological theory). México, DF, México: Universidad de Maryland, McGraw-Hill.

Romero, A., Díaz-Delgado, C., Martínez, T., Gómez, M. Á., Hernández M., Alberich, M. E., Mastachi, C. A., Hinojosa, A., & Becerril R. (2015). *La antropología en la planificación regional como elemento para la gestión integrada de los recursos hídricos*. Toluca, México: Universidad Autónoma del Estado de México. Recovered from http://hdl.handle.net/20.500.11799/59261

Sánchez-de-Puerta, F. (2006). Los tipos ideales en la práctica: significados, construcciones, aplicaciones. *Empiria. Revista de metodología de ciencias sociales*, 11, 11-32. DOI: 10.5944/empiria.11.2006.1107

Sánchez, J. (2012). Usos de los conceptos de gobernabilidad y gobernanza (una manera de diferenciarlos). En: Lerner, B., Uvalle, R., & Moreno, R. (coords.). *Gobernabilidad y gobernanza en los albores del siglo XXI y reflexiones sobre el México contemporáneo* (pp. 218-265). México, DF, México: Universidad Nacional Autónoma de México, Instituto de Investigaciones Sociales, Instituto de Administración Pública del Estado de México, A.C.

Silva, R. (1999). *Agua y subordinación en la cuenca alta del río Lerma* (tesis de maestría). Universidad Autónoma del Estado de México, Toluca, México.

Silva, J. A. (2014). *Propuesta de un modelo de gestión comunitaria del agua en México*. XIX Congreso Internacional de Contaduría, Administración e Informática. Octubre 8, 9 y 10. Ciudad Universitaria, México, DF, México. Recovered from https://investigacion.fca.unam.mx/docs/memorias/2014/10.09.pdf