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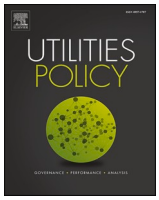

Full-length article

Motivating the formation of partnerships by small water systems

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ABSTRACT

Small community water systems (CWS) often have difficulty maintaining high-quality service provision. Partnerships can help alleviate these problems, yet may not be attainable or pursued. This research examines the perspectives of U.S. state agencies with drinking water primacy regarding the benefits of water systems partnerships and the points of leverage that can induce water systems to partner. It assesses the benefits, drawbacks, and barriers to five common forms of partnerships as well as the approaches states can use to encourage small CWS partnerships. Findings indicate that while partnerships hold significant potential, in many contexts, there are inherent limitations to their formation.

1. Introduction

Small community drinking water systems (CWS) provide an essential public service yet often face challenges in achieving quality standards. Not only do small CWSs struggle with meeting regulatory requirements (Fedinick et al., 2017; Gunnarsdottir et al., 2020; Marcillo and Krometis, 2019; McFarlane and Harris, 2018; Minnes and Vodden, 2017; Rickert et al., 2016; Rubin, 2013), they also face challenges related to finances; staffing, including finding and retaining certified operators; and management and administration (Blanchard and Eberle, 2013; Lieberherr et al., 2022; McFarlane and Harris, 2018; Norriss et al., 2021; Nylen et al., 2018). Small CWSs encounter greater difficulties than larger systems partly because they recuperate fewer funds from their customer base (Blanchard and Eberle, 2013). Further, many small CWSs are run by part-time or volunteer staff who lack technical and managerial expertise (Marcillo and Krometis, 2019; Maxwell, 2006; McFarlane and Harris, 2018).

To address these shortcomings, governments, professional associations, and scholars across the United States, Canada, Germany, Finland, and other countries are promoting partnerships (American Water Works Association, 2019; Breen, 2018; EPA, 2023b; Kurki et al., 2016; Martin, 2009; National Conference of State Legislatures, 2022; Riggs and Huges, 2019; Rural Community Assistance Program, 2021; Schmidt, 2014). Partnerships reflect a potential mechanism that could help small water systems expand their managerial, technical, and financial capacity and improve resilience through redundancy and emergency planning (EPA, 2017; Martin, 2009). Partnerships can enable water systems to improve their capacity by sharing knowledge and resources, and by achieving economies of scale, among other mechanisms (Feiock, 2013; Krause and Hawkins, 2021; Watson, 2015). However, even while partnerships have the potential to benefit small water systems, in many instances, they fail to emerge (Kwon and Feiock, 2010; Moseley and James, 2008). Partnerships may be challenging to form, have drawbacks associated with their formation, or not be viewed by water systems as the most appropriate way to address their problems.

Where partnerships do not autonomously form or increase their prevalence, policymakers may seek to influence their development (Moseley and James, 2008; Saz-Carranza et al., 2016). Policymakers can encourage partnership formation by various means, including support and sanction elements common to multi-level governance (Blum et al., 2015; Engel, 2015; Fisher, 2014). Some approaches to motivating partnership formation seek to change or influence the benefits and costs of collaboration to one or more parties, while other approaches are directed at the stage during which parties negotiate the structure of potential partnerships.

The extent to which governments have adopted policies and programs to encourage partnership formation by small CWSs and the approaches those policies and programs adopt for motivating partnerships vary. Some states have implemented multiple policies, while others have made little attempt to spur partnership formation. This research seeks to understand this variation within the United States by examining the perspectives of state primacy agencies on small CWS partnerships. Primacy agencies are the state-level governmental entities delegated implementation responsibilities and enforcement authority by the US

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Environmental Protection Agency under the Safe Drinking Water Act (SDWA). These agencies establish and enforce standards, monitor water systems for compliance, respond to violations, provide technical assistance, and educate water systems and the public about drinking water (EPA, 2023d).

Under the SDWA, to be eligible for federal funding, each state is required to develop and implement a capacity development program "to assist public water systems in acquiring and maintaining technical, managerial, and financial capacity" (42 U.S. Code § 300g–9 (c)). Most state primacy agencies have a staff person hired as the 'capacity development coordinator,' whose job is to implement and oversee the capacity development program. These individuals work closely with small CWS and have deep understandings of the context of water supply within their state. Their perspectives thus provide a grounded and complementary addition to the theoretical rationales for partnerships provided by federal agencies, scholars, and professional associations.

More specifically, this research illuminates the extent to which capacity development coordinators expect partnerships to benefit small CWSs in their state and what points of leverage state agencies think will most likely induce water systems to partner. The research begins with an analysis of small CWS challenges and the potential of partnerships to address them. This analysis also identifies factors that reduce the likelihood of small CWSs entering into partnerships, including the potential disadvantages of partnerships and barriers to their formation. Next, the research examines which approaches to motivating partnerships capacity development coordinators think would best lead to partnership formation and ascertains what policies and programs promoting partnerships are already being implemented. The result is a synthesis regarding the potential for small CWS partnerships and recommendations regarding gaps in knowledge that need to be filled to best guide the use and development of partnerships.

2. Small community water system partnerships

In the United States, a CWS is a public water system that serves at least 15 connections used by year-round residents or regularly serves at least 25 residents year-round. The term "small" describes CWS serving populations of 10,000 or less (EPA, 2022a). Across the US, there are 45,126 small CWSs spread across rural, peri-urban, and urban areas (EPA, 2020). Due to the history of water supply development, the structures for the ownership and operations of these systems vary and include municipalities, special districts, private companies, and community-owned systems often structured as cooperatives or homeowners' associations.

Partnerships can help small CWSs in various ways (for selected case studies, see EPA, 2022b; US Water Alliance, 2019). Many activities water systems must undertake, such as meter reading, billing, collections, and purchasing, become more cost-effective as scale increases (Bel and Warner, 2015; Eskaf and Moreau, 2009; Lieberherr et al., 2022; Shih et al., 2006). Through collaborations, small water systems may be able to overcome the lack of scale that commonly plagues small systems. Partnerships can also create efficiencies through the elimination of duplicative efforts. Water systems may be able to reduce staffing through the sharing of professional management, operators, or administrators who can work across multiple systems. Water systems may avoid costs by sharing equipment (Eskaf and Moreau, 2009; Minnes et al., 2018; Shih et al., 2006; Tran et al., 2019; US Water Alliance, 2019). Related, the increased buying power from working together may enable water systems to purchase rather than rent equipment or to develop in-house expertise rather than hiring out, reducing long-term operating costs.

Further, through partnerships, water systems may be able to devise capacity-sharing arrangements that manage the financial risk of substantial capital investments (Gorelick et al., 2019). By working jointly, water systems may also be able to demonstrate the benefits of projects to a bigger customer base, increasing their competitiveness for grant funding. Water systems may also achieve better terms and interest rates on bonds and loans (US Water Alliance, 2019).

In addition to financial benefits, partnerships may build managerial and technical capacity. By sharing knowledge and expertise, water systems can gain knowledge (Bendz and Boholm, 2019; Boyd and Bell, 1973; Minnes et al., 2018). Partnerships may also enable water systems to replace untrained, part-time, or volunteer staff with trained professionals. Further, if partnerships lead to greater staff capacity, staff may have the time and ability to participate in training opportunities. Lastly, partnerships can improve resilience through access to support or resources during emergencies.

Water system partnerships may take many forms (Fig. 1) and may occur across private, public and non-profit actors. Non-binding partnerships entail working together without legal obligations, whereas formal partnerships involve a binding relationship. Formal partnerships take various forms, ranging from arrangements by which one entity contracts with another to provide services, entities formally share staff, resources, and expertise, or two or more systems merge. This latter could include a larger system subsuming a neighboring system or two systems combining physical and managerial functions. Varying forms of partnerships can provide similar benefits. For example, capacity building through the sharing of knowledge and expertise can be achieved through both non-binding and formal partnerships. The benefits of economies of scale can also be derived from most forms of formal partnership. For example, bulk purchasing, sharing of production and treatment of water, and other activities characterized by decreasing marginal costs can be undertaken not only through consolidation but through joint ownership and contracting. However, the barriers and potential drawbacks of partnerships vary by partnership type. For example, consolidation or shared staffing entails considerable loss of autonomy compared to non-binding relationships.

Several factors may impede the formation of partnerships. There may be limitations to the extent to which partnerships address the challenges water systems face. For example, partnerships may not address widely shared regional problems, such as water shortages due to extended drought or a labor shortage. Partnerships may also be of limited use due to factors such as geography or density, which affect the potential for achieving economies of scale or other benefits (Carvalho et al., 2012; González-Gómez and García-Rubio, 2008; Klien and Michaud, 2019; McFarlane and Harris, 2018). Transaction costs and regulatory and legal constraints may impede partnership formation (Eskaf and Moreau, 2009; McFarlane and Harris, 2018; Norriss et al., 2021). Further, the benefits, costs, and risks of partnerships may not be experienced equally by all partners and will be affected by how the partnership is structured (Gorelick et al., 2019, 2022). Additionally, agencies may have concerns regarding maintaining local control and navigating diverging interests and missions of the agencies involved (Eskaf and Moreau, 2009; Lieberherr et al., 2022; Norriss et al., 2021).

Policies and programs that can be used to encourage partnership formation are diverse and utilize a variety of means to encourage partnerships. Approaches to motivating partnership formation range from removing legal barriers to partnership formation to financial incentives to obligations of partnership formation (Fig. 2). Interviewee choices regarding whether and which approaches to motivating partnership formation are likely influenced by which types of partnerships they view as most likely to address the challenges faced by small CWSs in their state, as well as their views regarding which actions will best overcome barriers to partnership formation within their state.

3. Methods

Semi-structured interviews were conducted with the capacity development coordinator from each state primacy agency. The formal title of these individuals varies by state; examples include Capacity Development Coordinator, Capacity Development Program Manager, Drinking Water Local Assistant Unit Manager, Drinking Water Program

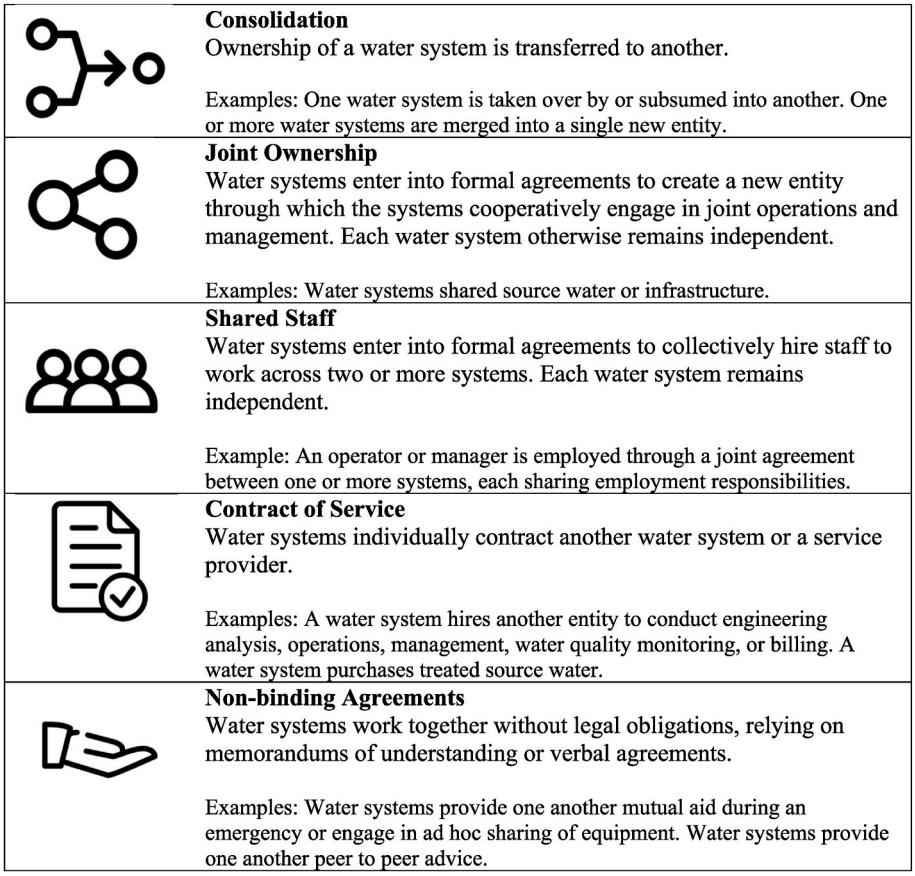

Fig. 1. Forms of water system partnerships. Source: Adapted from EPA (2023b).

Manager, or Environmental Protection Engineer. For states that do not formally designate a capacity development coordinator, interviews were conducted with officials identified by the state drinking water program as most involved with small CWSs and capacity development.

Representatives from 44 of 50 state offices participated in the interviews. Of the states that did not participate, two were experiencing staff turnover, three did not wish to talk with university researchers, and one declined citing their unique context in which counties own most of the state's water systems. Interviews were conducted via video conference or over the phone and lasted 45–60 min.

Interviews are useful for eliciting from experts their experiential knowledge and information not documented in written form (Wood and Ford, 1993). Semi-structured interviews allow research to explore topics in depth while maintaining consistency across interviews (Adams, 2015; Galletta, 2013). The use of interviews has substantial precedent in research on the water sector and has been used in numerous other studies (Bennett et al., 2014; Chalker et al., 2018; Dilling et al., 2019).

The specific interview protocol used is detailed in the Supplementary Online Appendix. Interviews began with an explanation of the research project, following which interviews were asked about the challenges faced by small CWSs in their state. The list of partnership types (Fig. 1) was shown and explained to interviewees, who were then asked about each type of partnership and the barriers to partnership formation. The list of approaches to motivating partnership formation (Fig. 2) was then shown and explained to interviewees, who were then asked which approaches would be most effective in their state. Lastly, interviewees were shown their state's catalog of policies and programs that seek to foster partnership formation as listed by the EPA (2017) report on Water System Partnerships and asked to confirm whether those policies and programs are still being implemented, whether any policies or programs were missing, and which policies or programs were most and least effective. Interviews were recorded and transcribed verbatim. Transcripts were coded using the standard iterative approach of a priori and inductive coding (Miles et al., 2013). Codes, definitions, and coding were cross-checked among the two researchers.

4. Perspectives on partnerships and small CWSs in the United States

Perspectives regarding promoting partnership formation are intrinsically linked to views on the potential of partnerships to address the challenges confronted by small CWSs. To understand these perspectives, we elicited information on the unique challenges faced by small CWSs in each state (Section 4.1), the advantages and disadvantages associated with different partnership types (Section 4.2), and the obstacles impeding the formation of partnerships for small CWSs (Section 4.3). A summary of these responses is presented in Fig. 3.

4.1. Challenges faced by small CWSs

The three challenges most frequently mentioned by interviewees include problems related to management and human resources (thirty-nine interviewees), financial instability (thirty-one interviewees), and aging infrastructure in need of repair or replacement (fifteen interviewees). Interviewees also indicated that small CWSs in their state face problems related to compliance with regulations (eleven interviewees), water availability (seven interviewees), source water quality (five interviewees), and maintaining water quality throughout the distribution system (six interviewees).

In terms of management and human resource challenges, as one interviewee commented, "*Everyone is struggling with staffing.*" Many small systems rely on part-time or volunteer staff, who often have limited

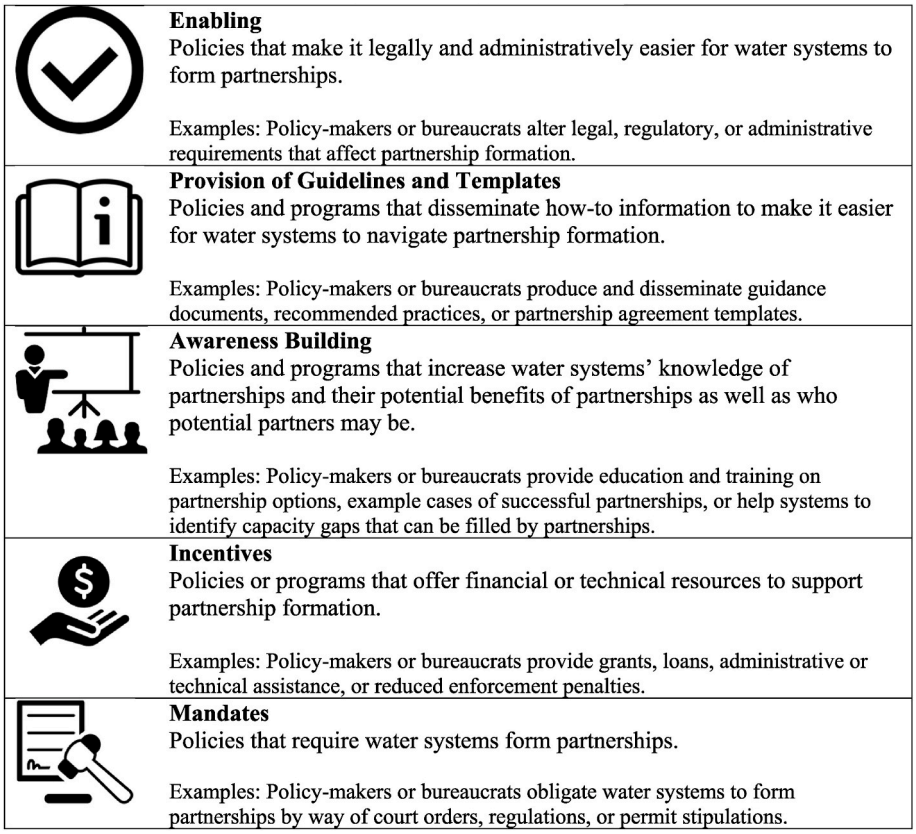

Fig. 2. Approaches to motivating partnership formation. Source: Authors.

	Consolidation	Joint Ownership	Shared Staffing	Contracting of Service	Non-Binding
Benefits					
Increased knowledge and expertise	●	●	●	●	●
Increased human resource capacity (management, operators, staff)	●	●	●	●	○
Economies of scale	●	●	○	●	○
Increased access to funds	●	●	○	○	○
Access to equipment or alternative source water	●	●	○	●	●
Short term assistance	○	○	○	●	●
Drawbacks					
Loss of autonomy	●	●	●	●	●
Reduced financial independence	●	●	●	●	○
Potential loss of revenue streams	●	●	○	○	○
Need to change organizational practices	●	●	●	○	○
Barriers					
Geography (distance, topography)	●	●	●	●	●
Cost of partnership formation	●	●	●	●	●
Existing capacity deficit	●	●	○	●	●
Equity considerations	●	●	○	○	●
Political will	●	●	●	●	●
Lack of awareness	●	●	●	●	●

● = Interviewees mentioned as a benefit, disadvantage, or barrier
○ = No interviewees mentioned as a benefit, disadvantage, or barrier

Fig. 3. Summary of commonly mentioned benefits, drawbacks, and barriers to partnerships.

technical and managerial knowledge and expertise. An effect of this human resource constraint is that small CWSs often cannot develop asset management, capital improvement, or contingency plans. Finding and retaining certified operators is also problematic. Many interviewees reported a paucity of certified operators in the employment pool, and said that even in locations where certified operators can be found, small CWSs lack the finances to employ them as full-time employees, let alone to pay high enough wages to retain them.

Beyond human resources, interviewees described finance as a major problem for small CWSs. As described by one, "Often times their [small CWSs] user base is so small that they don't have sufficient revenues." Interviewees explained that small systems often do not recover enough revenue through rates. While systems of all sizes often charge inadequate rates, interviewees noted that small systems find it more difficult to raise rates due to pressures from their users, who in many instances must approve the rate increase. Further, interviewees said small CWS charge lower rates than larger CWS because the users of small, and particularly rural, CWSs, often have lower incomes. The resulting lack of funds leads systems to focus on short-term functioning rather than planning for long-term maintenance and sustainability.

Further, interviewees stated that for many small CWSs, the water system is not the primary business concern of the water system owner, and existing funds are not prioritized for the water system. For example, one interviewee explained, "*A small mobile home park owner doesn't want to spend money hiring a water operator or sending someone to get a license*." Another interviewee explained, "*[Municipal systems use the water system] revenues to help pay for their police department, mayor, so water is the thing they leave in the past and hope nothing breaks down*."

Interviewees also concurred that infrastructure is a common problem. As explained by one interviewee, "*Small water systems oftentimes are near or past the end of their useful life in terms of infrastructure*." Financial constraints limit the ability of small CWSs to maintain, repair, and replace infrastructure. In addition, due to low managerial capacities, systems are often operated with a focus on the near term and plans that anticipate and plan for future infrastructure needs are lacking.

4.2. Benefits and drawbacks of partnerships

When asked to describe the benefits and drawbacks of partnerships for small CWSs in their state, most interviewees immediately discussed consolidation. The prevalence of this response indicates the extent to which consolidation dominates the discourse on partnerships. Interviewees were next most likely to discuss contracting of service and shared staffing as partnership options. In contrast, most interviewees required prompting to contemplate non-binding partnerships and joint ownership.

Regarding consolidation, twenty-seven interviewees thought small CWSs within their state not currently engaged in consolidation could benefit from it. Interviewees noted that small CWSs located geographically proximate to larger systems, mainly municipally owned ones, would most likely benefit from consolidation. The advantages of consolidation cited included increased technical, managerial, and financial capacity through sharing expertise and resources, access to water sources, and the potential to achieve economies of scale through source production and treatment as well as administration. Interviewees also acknowledged potential drawbacks. Interconnecting systems may change the chemical composition of water, creating a need for additional treatment or corrosion controls, or may change the residence time of water in the distribution system, affecting the formation of disinfection byproducts. Financial drawbacks were also raised, including loss of financial independence or revenue. Moreover, small CWSs may be averse to consolidation due to the fear that loss of responsibility for water supply will reduce the purpose and strength of their local government. Interviewees described this as a concern particularly relevant to small rural communities in which local government has few formal paid positions and for which, beyond road maintenance and keeping track of vital records, water service is the primary responsibility of their local government.

Joint ownership was viewed with less optimism. Twenty-three interviewees thought small CWSs in their state could benefit from joint ownership but would be unlikely to adopt it. Interviewees primarily perceived joint ownership as a means for obtaining additional water supplies, infrastructure, or equipment. However, conflicting management styles or concerns over the equitable distribution of work could complicate such partnerships. Interviewees also noted that small CWS may also be concerned that joint ownership would eventually lead to one of the systems being subsumed into the other, causing loss of jobs and local control.

Shared staffing was seen as having greater potential due to the widespread staffing challenges faced by small systems. Twenty-one interviewees thought small CWSs in their state could benefit from it. Shared staffing was described as a solution to limited funds and the limited pool of available employees. It could enable the hiring of full-time employees, reducing reliance on part-time staff and volunteers while concurrently addressing human resource problems related to retirement and retainment. However, interviewees noted that shared staffing has its drawbacks. Establishing such partnerships would require new internal procedures and work across the management styles of partnering entities. Systems would also need to address equity workload sharing and expertise. For example, interviewees expressed concerns that shared managers and operators may not have equal knowledge of all systems and the risk of operators being responsible for too many systems, compromising oversight. Additionally, some CWS may be reluctant to share staff due to a desire to preserve their independence.

Interviewees described service contracting as the partnership type with the greatest potential to improve the technical and managerial capacities of small CWSs. Twenty-seven interviewees thought that systems in the state could benefit, with ten going so far as to claim that <u>*all*</u> small CWSs in their state would benefit from contracting. Interviewees described contracting as a primary means of obtaining missing expertise, addressing gaps arising from a lack of in-house staff, and filling ongoing or temporary staffing shortages. Small CWSs tend not to have engineers on staff, thus commonly outsource the design, construction, repairs of infrastructure, and water quality monitoring. Interviewees acknowledged that a drawback of contracting is that contracted employees may be less motivated than on-staff employees who live in the community and have a vested interest in ensuring quality work. Contracting also requires managerial oversight and the development of procurement and billing systems.

Lastly, although many interviewees did not consider non-binding arrangements a form of partnership until prompted to do so, interviewees recognized the importance of non-binding partnerships. Thirty-one interviewees thought most small CWSs in their state could benefit from non-binding partnerships. Non-binding partnerships were beneficial for addressing immediate and short-term needs arising from weather events or infrastructure failure. During such circumstances, small CWSs would benefit from sharing equipment or supplies, including access to other water sources. However, interviewees noted drawbacks, such as decreased self-reliance and potential delays in assistance due to unfamiliarity with the partnering system. Additionally, systems with higher capacity may be disproportionately burdened with requests for assistance, leading to a reluctance to form non-binding partnerships.

In addition to addressing the benefits and drawbacks specific to each type of partnership, interviewees also commented on concerns generalizable across all types of partnerships. More than half of interviewees (twenty-six) said small CWSs would be reluctant to enter partnerships due to the need to relinquish control or concerns about reliance on another system. Further, interviewees noted that some small CWSs may not be aware of or fully understand the potential long-term benefits of partnering. Interviewees explained this was because water system owners tend to pay more attention to the initial costs of a partnership rather than evaluating long-term gains.

4.3. Barriers to partnership formation

Interviewees described six barriers to partnership formation: geography, costs, capacity, equity, politics, and a lack of awareness.

The location of small CWSs influences the feasibility of partnerships and the types of partnerships that can be pursued. Twenty-three

interviewees described geography as a barrier to partnerships. Physical geography affects the ease and location in which interconnection pipes can be laid, while distance influences the costs of infrastructure, travel time, and communication. Interviewees noted that consolidation and joint ownership could be particularly challenging for rural water systems due to their distance from neighboring systems. Shared staffing partnerships also face obstacles, as managers and operators' quick on-site access and some interviewees noted their state's regulations require operators to be within a specified travel time from the system(s) they operate (see e.g., 310 CMR 22.11B(5)(a)(4); 15A NCAC 18D 0.0701 (b)(8)). Distance complicates non-binding partnerships by making sharing equipment and emergency support more difficult.

Costs were also identified as a significant barrier, with twenty-one interviewees describing financial constraints to partnership formation. Initial financial resources are often necessary for all but non-binding partnerships. Funds are needed for interconnecting piped systems, investing in shared infrastructure, and employing shared staff. Many systems lack available capital, and securing grant funding or financing requires human resources and time. Interviewees also noted that contracting could be more expensive than hiring staff, as contractors charge overhead and only complete agreed-upon tasks, whereas staff take on responsibilities and needs as they arise. Non-binding partnerships, although not subject to the same concerns, may face constraints related to insurance coverage or other financial processes when providing informal support to other systems.

In addition to direct financial costs, partnership formation involves substantial transaction costs. Seven interviewees highlighted that small CWSs often lack the managerial and human resource capacity to identify potential partners, develop partnership parameters, and implement partnerships. Contracting was specifically mentioned, requiring a small CWS to schedule, plan, and anticipate service needs. Some interviewees noted that small CWSs might prefer the state to organize partnerships due to the high burden of identifying feasible partners, scheduling meeting times, and establishing partnership details.

The uneven distribution of costs and benefits was also cited as a barrier to partnership formation. Six interviewees noted that higher capacity CWS often hesitate to partner with lower capacity CWS due to the high or uncertain costs. Many small CWSs lack complete inventories or assessments of their infrastructure conditions and may have outstanding debts or ongoing water quality issues, making partnering through consolidation or joint ownership an uncertain proposition.

Eleven interviewees identified politics and conflicts as barriers to partnership formation. Local leadership, particularly for publicly owned CWS, is critical as community officials (a mayor, board, or council) play a vital role in partnership approval. Sometimes, a partnership may also be subject to a public vote. Political officials may utilize partnership discussions to serve their own interests. Politics and rivalries between towns can affect willingness to collaborate, and systems may be hesitant to partner if there is a risk that the partnership will be terminated with changes in community leadership.

Lastly, there is a lack of awareness of the need for, the forms of, and the potential benefits of partnerships. Thirteen interviewees highlighted that small CWSs often lack knowledge about the various types of partnerships or how each type could benefit them. Managers of small CWSs may struggle to find information about partnerships or how to initiate one. Interviewees identified non-binding partnerships as the least understood in terms of their value. Additionally, high staff turnover can lead to a loss of institutional knowledge, requiring the education of new staff members about the benefits of partnerships.

5. Approaches to motivating partnership formation

Interviewees were next asked their perspectives on the differing approaches to motivating partnership formation and to pick the top two most useful for bringing about partnerships by small CWSs in their state. In selecting the top two approaches for motivating partnership formation, more than half of the interviewees ranked multiple approaches as tied for most useful. Incentives were most frequently selected as the most useful, followed by providing guidelines and templates and awareness building. Mandates and enabling were selected least often (Fig. 4). When discussing the approaches to motivating partnership formation, interviewees often noted that most approaches do not address the primary drawbacks of and barriers to partnerships (Fig. 4). Providing guidelines, templates, awareness building, and incentives address more disadvantages and barriers than enabling and mandates. However, none of the approaches to motivating partnership formation address concerns about loss of autonomy and reduced financial independence, nor do they resolve geographic barriers to partnership formation.

Opinions on enabling were mixed, with eight interviewees saying enabling could help catalyze partnership formation, six interviewees noting that enabling policies would not be effective, and others not having a clear opinion. Interviewees who thought enabling would be useful said reducing or removing legal barriers would open new avenues for systems to form partnerships. Further, laws that outline requirements and steps necessary to partner would help streamline the process. However, interviewees also commented that enabling may reduce institutional barriers to partnership formation, but it would not address systems' (lack of) motivation to partner. Moreover, enacting enabling legislation requires substantial effort and may not be feasible. For these reasons, enabling was infrequently selected as the top approach to motivating partnership formation. Of the four states that included enabling in their ranking of the top two approaches to motivating partnership formation, only one provided a reason. This interviewee said, "*Anything to ease the red tape to solidify these partnerships* [is worth trying]." Interviewees who did not select enabling as a top approach rationalized their choice by saying they either did not have or were not sure there were legal or policy barriers to partnerships within their state.

There was greater consensus regarding the usefulness of providing guidelines and templates and awareness building, with twenty-three and thirty interviewees, respectively, indicating that such approaches to motivating partnership formation would be helpful, and seventeen and fifteen interviewees selected those policies as top policies for motivating partnership formation. Regarding providing guidelines and templates, interviewees argued that small CWSs need more guidance to understand how to partner and help identify partner options. At the same time, six interviewees stated that guidelines and templates would not be useful, arguing that they do not address the main barriers that prevent systems from partnering.

Regarding awareness building, interviewees commented that such approaches to motivating partnership formation can help small CWSs understand the potential of partnerships to fill capacity needs and the resources available to support partnerships. As one interviewee explained, "*Building awareness and letting systems know that they have that potential, and they have that ability [to partner], whether it's mutual aid agreements or entering into contracts with contract operators*." Awareness building also exposes systems to the concept of partnering multiple times. As one interviewee commented, "*Sometimes it's not the first time you mention it where it clicks; it's the fifth or sixth time you mention it where they are like, oh, maybe I should look into that.*" In addition, examples of successful partnerships were considered helpful to improve small CWS understanding of the potential for beneficial partnerships. However, a handful of (five) interviewees thought that awareness building would increase knowledge of partnerships as an option, but it would not overcome the lack of interest or barriers to partnership formation.

A few interviewees rationalized providing guidelines and templates or awareness building as top approaches because they could be quickly implemented and help dispel misinformation. In contrast, several interviewees who did not select either approach as a top choice explained that there were already enough guidelines, templates, and awareness about partnerships in their state.

A majority (thirty) of interviewees thought incentives would help

	Approach to Motivating Partnership Formation				
	Enable	Provision of Guidelines/ Templates	Awareness Building	Incentives	Mandates
Rank of Approach to Motivating Partnership Formation					
Number of interviewees ranking approach as 1st choice*	3	17	15	25	5
Number of interviewees ranking approach as 2nd choice	1	5	4	9	2
Drawbacks					
Loss of autonomy	○	○	○	○	○
Reduced financial independence	○	○	○	○	○
Potential loss of revenue streams	○	○	○	●	○
Need to change organizational practices	○	◒	○	○	○
Barriers					
Geography (distance, topography)	○	○	○	○	○
Cost of partnership formation	○	◒	○	●	○
Existing capacity deficit	◒	◒	○	◒	○
Equity considerations	○	◒	◒	●	○
Political will	○	○	◒	○	◒
Lack of awareness	○	○	●	○	◒

*21 interviewees rated multiple policies as tied for #1 top choice
● = Approach to motivating partnership formation directly helps to overcome this disadvantage or barrier
◒ = Approach to motivating partnership formation can (at least partially) help address this disadvantage or barrier
○ = Approach to motivating partnership formation does not address this disadvantage or barrier

Fig. 4. Relationship between approaches to motivating partnership formation and drawbacks of and barriers to partnership formation.

encourage partnership formation, with twenty-five selecting it as the top approach to motivating partnership formation. Interviewees explained that providing funds and other resources would help overcome the financial, technical and managerial barriers to partnership formation. Incentives could compensate small CWSs for any additional financial costs incurred by a partnership. They could also reduce the financial risks of partnering and serve as a reward for choosing to partner. As explained by one interviewee, incentives would make it easier for systems to decide "*this [partnership] is a no-brainer financially*" and make it easier for leaders to leave the partnership decision to constituents. However, three interviewees acknowledged that there are limitations to incentives. Applying for incentives requires capacity that some small systems do not possess; thus, the least capable systems would be unable to take advantage of incentives. Further, interviewees noted that some small CWSs may perceive accepting incentives from the state as undermining their self-reliance.

Interviewees who selected incentives as the top approach for motivating partnership formation explained that incentives would be a more direct benefit to small CWSs than other systems, would be more likely to get projects off the ground and would have quicker results than other approaches to motivating partnership formation. Several commented that incentives have worked in the past, and if further incentives were available, more systems would form partnerships. These interviewees said incentives work because they address financial barriers to partnerships and smooth the way for systems to see the benefits of partnership formation. One interviewee also explained that of all the approaches to encouraging partnership formation, incentives require the least effort for state agencies to implement. Three interviewees who did not choose incentives within their top-ranked approaches to motivating partnership formation explained that there are plenty of incentives already available within their state, and more would not further catalyze partnerships.

Mandates were viewed as leading to partnership formation, yet limited in how they could bring about partnerships. Nine interviewees said implementing mandates would be helpful, fifteen interviewees did not think mandates would be a good approach, and the remainder had mixed views. Only four interviewees selected mandates as the top approach to motivating partnership formation. Interviewees in favor of mandates said at times, mandates may be the only way to bring about partnerships. These interviewees were primarily focused on mandates that require consolidation through takeover or entail receivership and said mandates would benefit systems with chronic compliance issues, infrastructure problems, and staffing shortages. They also explained that mandates would generally only be used to force such systems to partner. Other interviewees thought that while mandates might create partnerships, they might lead to unsuccessful partnerships, particularly as the systems required to partner might not respond well to the mandate. As explained by one interviewee, "*Systems need to want to enter into partnerships; they need to buy in.*" Interviewees also commented that mandates are resource-intensive, requiring substantial resources and effort by the state to implement and enforce. Further, several interviewees commented that they either were unsure whether mandates would be legal or that it would be challenging to put mandates into law, as such an approach would not align with the political climate in the state.

When selecting their top two approaches to motivating partnership formation, many interviewees discussed interactions between approaches, with some interviewees noting that multiple approaches are best implemented concurrently, while others discussed the value of applying differing approaches sequentially. Interviewees who thought multiple approaches to motivating partnership formation should be implemented concurrently explained that varied approaches can play a supporting role in one another's effectiveness. For example, awareness building spreads knowledge of partnership benefits while providing guidelines and templates to help systems initiate partnerships. As another example, a mandate would force systems to partner, and an incentive would make the mandate more palatable. Interviewees who discussed the sequential implementation of approaches to motivating partnership formation explained that such efforts could build upon one another. For example, awareness building and guidelines and templates are key to getting systems up-to-speed on why partnerships are a good

option and how to navigate the process. However, once systems are made aware of why this strategy could be right for them, incentives can help push them over the edge in deciding to pursue partnerships. Another combination would be to enact enabling legislation that clears the way for partnership formation, then awareness building to help systems understand the benefits of partnering and provide incentives to reduce the perceived risk of partnerships. There was no consensus among interviewees about which combinations of approaches to motivating partnership formation should be used in which order or simultaneously.

6. Policies and programs used to motivate partnership formation

All states have adopted multiple policies or programs that encourage partnership formation (Table 1), with states adopting between two and seven policies or programs. Policies and programs vary in their approach to motivating partnership formation, with most states adopting that contain at least two different approaches. Some policies or programs rely on a single approach (e.g., solely providing guidelines and templates), while others utilize multiple approaches to motivating partnership formation concurrently (e.g., including both awareness building and incentives).

Common state policies and programs include the Drinking Water State Revolving Fund (DWSRF); the Water Agency Response Network (WARN); formal technical-managerial-financial capacity assessments; regional planning; regulation, guidance and support for operator-sharing; and requirements that apply only to new systems, requiring them to assess potential interconnections. Details on these most prevalent policies and programs are below. Some of these policies and programs, particularly the DWSRF and capacity assessments, stem from federal law and policies, yet within their authority, states have tailored those federal requirements to their state.

The Drinking Water State Revolving Fund (DWSRF) is a program managed by states that provides financial assistance to CWS (EPA, 2023a). Federal grant funding provides initial capitalization grants with matching funds from states. States then lend the money to public water systems. Loan repayments are returned to the fund, and the monies are loaned out again. While all US states have a DWSRF program, forty of the states interviewed have adapted aspects of this program to encourage partnership formation. Funds from the DWSRF serve as an incentive, as many states prioritize funding proposals from water systems planning to engage in partnerships, primarily consolidation. Several states have integrated awareness building into the program by

Table 1
Summary of policies and programs used by the 44 states in the study, by approach to motivating partnership formation.

POLICYor PROGRAM	# of States Implementing the Policy					Total # of States implementing
	Enable	Provision of Guidelines/Templates	Awareness Building	Incentive	Mandate	
Drinking Water State Revolving Fund (DWSRF)						
- Prioritizes applications federal DWSRF loans or provides set-asides for projects that involve partnerships	–	–	–	38	–	
- Requires systems to undertake capacity assessments that consider partnerships as part of the DWSRF application process	–	–	6	–	–	
- Uses DWSRF funds to help systems conduct studies and plans, including consolidation studies	–	–	–	1	–	
- Uses DWSRF funds to support regional planning	–	–	1	–	–	40
Water Agency Response Network (WARN)	15[a]	–	–	–	–	15[a]
- Creates an institutional arrangement for systems to ask one another for support						
- Helps systems know what resources/expertise one another has	–	–	15[a]	–	–	
- Requires small CWSs to join WARN	–	–	–	–	1	
Formal Technical/Managerial/Financial Capacity Assessment	–	–	16	–	–	16
- Help systems identify their limitations/needs and has them consider the potential of partnerships in meeting them						
Regional Planning	–	–	9	–	–	11
- Development of plans that identify water needs service areas and promote coordination between systems						
- Source water protection planning	–	–	2	–	–	
Operator Sharing	6	–	–	–	–	14
- Specify requirements for operators working multiple systems						
- Guidelines for contracts and responsibilities between system owners and operators	–	4	–	–	–	
- List available of certified operators for hire	–	–	3	–	–	
- Facilitates peer-to-peer operator advice	–	–	2	–	–	
Proposed New Systems Must Consider Partnership	–	–	6	–	–	20
- Proposed new systems must demonstrate technical, managerial, and financial capacity or interconnect						
- Proposed new system must evaluate interconnection	–	–	16	–	–	
- Proposed new system must be owned or operated by an approved satellite management agency	–	–	–	–	1	
Other Policies						
- State ordered consolidation or receivership	–	–	–	–	14	30
- Financial assistance to support partnership formation	–	–	–	15	–	
- Technical assistance to support partnership formation	–	–	–	7	–	
- Enforcement actions that encourage partnership formation	–	–	–	4	–	
- Legislation that allows or facilitates partnership formation	3	–	–	–	–	
- Other partnership requirements	–	–	–	–	2	
- Other capacity development that builds awareness	–	–	6	–	–	
Number of States with Policy	17	4	42	43	16	n/a
Max number of Policies per State	2	1	3	3	2	n/a
Total Number of Policies (across all States)	23	4	77	65	18	n/a

[a] All but one US state has a WARN network, yet only 15 interviewees noted that their state agency had an active role in supporting WARN in their state.

including a required capacity assessment that considers partnerships as part of the DWSRF application process. This assessment helps to identify systems' weaknesses and needs, requiring systems to make plans to address them. Interviewee perspectives on the effectiveness of the DWSRF in fostering partnerships were mixed. Financial support facilitates partnerships by providing resources to undertake the partnership; however, states' DWSRF budgets are limited, constraining the number of systems that receive each year. Additionally, the DWSRF can only facilitate partnerships if water systems apply for funding. Very small CWSs with limited capacities often cannot apply for the DWSRF without assistance.

Another program promoting partnerships is the Water/Wastewater Agency Response Network (WARN) (EPA, 2023c). Although WARN is an independent network rather than a state government policy/program, state primacy agencies frequently assist in organization and training and provide financial and administrative support to the network within their state (EPA, 2015). WARN exists in forty-nine states, yet only fifteen interviewees explicitly stated that their state agency has a formal role in the network. WARN combines an enabling and an awareness approach to encouraging the formation of non-binding partnerships. It establishes a framework for water systems to voluntarily enter into mutual aid agreements to support one another during emergencies by sharing staffing, equipment, and other resources. WARN enables partnership formation by providing a platform for communication and requests among CWS and by outlining terms for how liability, worker's compensation, insurance, and or reimbursement for mutual aid might work (EPA, 2023e). WARN also engages in awareness building, actively recruiting new participants and providing training and exercises to help systems prepare for emergencies and understand the benefits of mutual aid. While interviewees thought WARN was very effective, some mentioned its limitations. Small CWSs can be hesitant to participate due to their perceived inability to provide aid. Additionally, as WARN is only activated during emergencies, it does not address the many chronic problems small CWSs face.

Formal technical, managerial, and financial capacity assessments are another mechanism through which states seek to motivate partnership formation. Through such assessments, states aim to build awareness of the potential benefits of partnerships. While as noted above, all states have a capacity development program, not all capacity development programs address on partnerships. Sixteen states indicated their capacity assessment programs include formal assessments that help small CWSs understand their capacity gaps and specifically encourage small CWSs to identify potential solutions to their weaknesses, including through partnerships. While these policies and programs educate systems, interviewees said a drawback of capacity assessment is that while it can encourage partnerships, it does not directly overcome barriers, such as the cost needed to form partnerships.

States also engage in regional planning efforts to encourage partnerships. Regional planning takes various forms, with some planning focused on economic development and growth while other planning efforts specifically target water resources management. Eleven states utilize regional planning efforts to motivate partnership formation. Some include enabling policies that allow water systems to enter into cooperative agreements as part of the planning process, often with the objective of joint source water management. Others include establishing a governing body that oversees mergers, consolidations, and annexations. Awareness building is also a central component of regional planning, as it helps water systems identify existing and future service areas, population and community needs, and potential partners. In some states, regional planning is also tied to mandates, such as when planning stipulates that new water districts cannot be formed if located next to an existing water system that can provide service. Interviewee perspectives on the effects of regional planning initiatives varied. While regional planning facilitates partnerships by bringing systems into conversation with one another, interviewees acknowledged that regional planning efforts often do not have the necessary resources and policy support to implement the plans developed. Additionally, small CWSs may lack the human resources to engage in regional planning efforts fully, let alone plan for the long term.

Development of policies and programs facilitating operator sharing is another way states motivate partnership formation. Fourteen states have adopted operator-sharing policies and programs that directly enable operator sharing or contract operators through regulations or that support operator sharing through the provision of information. Enabling approaches explicitly allow certified operators to work across multiple systems as shared staff or through contracted services. Some also provide clarity by stipulating requirements of operators working across multiple systems, such as the frequency at which an operator must be on-site or travel distance between the systems the operator supervises. Informational approaches either provide guidelines and templates or seek to connect operators across systems. For example, some operator-sharing policies and programs provide boilerplate language describing duties and responsibilities to be included in contracts. Others create databases of operators to facilitate both formal (i.e., shared staff or contracted operators) or non-binding (i.e., operator-to-operator mentoring) partnerships. While the operator-sharing policies and programs assist systems in identifying, hiring, and supporting operators, interviewees noted that the policies do not address the lack of certified operators in the employment pool or the willingness of individuals to accept the work.

While all of the above policies and programs apply to existing systems, twenty states also have policies that apply specifically to new proposed small CWS. These states require applicants for new small CWS consider interconnection or merger with an existing system before applying for a permit. Permit applications must explain why a new system is necessary instead of connecting to an established one and, in some instances, must demonstrate connection is infeasible. Some of these policies also require proposed private systems to demonstrate continuity of service in case of system failure, such as through performance bonds, letters of credit, or merger agreements.

In addition to these commonly occurring categories of policies and programs, various other state policies and programs seek to foster the development of partnerships by existing systems. These include state-ordered receivership or consolidation, additional financial or technical assistance programs, enforcement actions, and enabling legislation.

The approaches to motivating partnership formation used by existing policies and programs mostly align with interviewee rankings: states predominantly encourage partnerships through incentives and awareness building. However, more states have adopted policies and programs enabling and mandates providing guidelines and templates. A few patterns emerge. Policies and programs that adopt an enabling approach to motivating partnership formation focus mainly on encouraging non-binding agreements or addressing problems related to certified operators. Policies and programs that provide guidelines and templates seek to address problems related to certified operators. Policies and programs that build awareness have a broad scope of objectives, though notably a subset of policies and programs that build awareness focus specifically on potential new systems, requiring they consider interconnections. Policies and programs that include incentives predominantly include funding, compared to technical or managerial assistance, and often aim to encourage consolidation. Mandates are primarily directed towards consolidation, typically targeting systems with ongoing non-compliance with Safe Drinking Water Act requirements, though a handful of states had requirements that small CWS engage in partnerships for emergency planning and response or for water quality monitoring.

7. Discussion

Our research finds that capacity development coordinators from state primacy agencies have mixed views on small CWS partnerships. While partnerships may help to resolve problems commonly faced by small CWSs, there are limitations to what partnerships can achieve and

impediments to their formation. Further, although states can take steps to encourage partnership formation, approaches to motivating partnership formation are imperfect and may not suffice to bring about partnerships.

Specifically, interviewees identified a variety of challenges faced by small CWSs. These challenges range from management and human resources, financial instability, aging infrastructure, regulatory compliance, source water availability and quality, and maintaining water quality through the distribution system. Partnerships can help to remediate many of these challenges by increasing human resources and financial capacities and providing access to additional supplies and equipment, among other benefits. However, where the challenges faced by small CWSs are systematic across a region, partnerships may not suffice. For example, interviewees consistently described widespread human resource shortages. The aging workforce, shortages of trained operators, and few younger employees joining the water sector also plague large CWS. While partnerships can reduce staffing needs, they cannot overcome the economy-wide scarcity of potential employees. Similarly, where all potential partners face the same water availability or water quality problems, there may be limits to what partnerships can overcome.

In addition, interviewees acknowledged that partnerships are not without their drawbacks. Small CWSs may experience a loss of autonomy, reduced financial independence, and changes to revenue streams when forming partnerships. They also may need to address or make changes to organizational processes. Small CWSs will weigh the risks of these drawbacks as they contemplate whether partnerships are the best solution to their challenges. While the risks of partnerships are well acknowledged in research on inter-agency collaboration (Carr and Hawkins, 2013; Terman et al., 2020), the discourse on partnerships and the entities pushing for water systems partnerships have not sufficiently acknowledged these shortcomings nor developed ways to overcome them. More effort is needed to develop innovative structures for partnerships and water supply, more broadly, that will alleviate local concerns about the potential risks of partnerships.

The barriers to partnership formation described by interviewees are similar to those that affect any collaboration, though two – geography and availability of prospective partners - are particularly problematic for small CWSs. Geographic distance is a real-world constraint that is difficult to overcome. Partnerships may be particularly untenable for rural small CWSs far from other systems. Technological innovations, including remotely connected sensors and video conferencing, may facilitate partnerships for geographically dispersed systems. Further, certain partnerships – particularly contracts and satellite management –may only necessitate intermittent on-site presence. However, consolidation through physical interconnections and partnerships that require steady in-person presence will be infeasible. A lack of willing partners may also reduce the potential for partnerships. Many interviewees noted that a partnership's benefits can be one-sided, helping the weaker system yet costing the stronger system. Systems that are financially unsustainable or have high needs for infrastructure repairs or replacement may be unattractive to potential partners.

In terms of the many forms of partnerships, interviewees indicated that all forms of partnerships would be helpful to small CWSs within their state, though suggested consolidation, contracting, and non-binding partnerships would be most beneficial. The emphasis on consolidation reflected the interviewees' familiarity with this type of partnership and that most states actively encourage consolidation, particularly among failing water systems. While consolidation is highly regarded, interviewees provided the strong caveat that consolidation would only benefit a subset of small CWSs in the state, whereas contracting and non-binding partnerships would benefit *all* small CWSs in their state. This distinction is relevant from a policy perspective, as it is not widely made in the literature or policy statements by advocates of water systems partnerships, which tend to emphasize consolidation.

To foster partnership formation, interviewees strongly recommended awareness building, incentives, and providing guidelines and templates. These three approaches to motivating partnership formation more actively encourage action rather than enabling policies. Notably, awareness building, and incentives stimulate interest in partnership formation, whereas providing guidelines and templates helps make it easier to enter into partnerships. In addition to being a more active approach to encouraging partnerships, awareness building, incentives, and providing guidelines and templates, it also addresses a greater variety of barriers to partnership formation than enabling and mandates. Interviewees also noted that a multi-faceted approach to motivating partnership formation may be necessary due to the multiple barriers to partnership formation. For example, technical and financial support may be needed to overcome the capacity constraints that preclude participation by small CWSs with such low capacities that they cannot apply for incentives, participate in training, or use information.

Nonetheless, none of the approaches to motivating partnership formation address all barriers and few remedy the drawbacks of partnerships. Moreover, beyond the limitations of encouraging partnerships as a method, there are also constraints on states' abilities to implement policies and programs. Many interviewees described their agency as subject to inadequate staffing and other capacity constraints. This context should be considered when evaluating whether and how to motivate partnership formation. Policies and programs not accompanied by the resources (human or financial) necessary for implementation may not achieve their intended effects, even if they are well-designed to bring about change.

7.1. Future research

This analysis of capacity development coordinator perspectives on small CWS partnerships indicates the need for a greater understanding of partnerships. First, while this research identified commonalities and differences in perspectives across states, it does not constitute a systematic survey of small CWSs and the potential for partnerships across the United States. Semi-structured interviews provide invaluable insights yet do not comprehensively collect information in a standardized manner. For this reason, counts of the number of states citing the challenges of small CWSs, benefits and disadvantages of partnerships do not necessarily reflect the prevalence of that perspective. In addition, while interviewees were presented and asked to update the EPA (2017) inventory of policies and programs seeking to motivate partnership formation, they were not asked to research and create a detailed inventory of every policy and program in their state. Thus, while the dataset does not include non-existent policies and programs, some newer policies might have been inadvertently omitted.

This gap is particularly evident in enabling policies. While the EPA (2017) inventory and interviewees identified a handful of state-level policies guiding and authorizing interlocal government agreements (see e.g., RI Gen Laws§ 45-40.1-4.; K.S.A. §12–2901; R.C.W. § 39.3), many interviewees acknowledged they were unaware of the entirety of state laws that set parameters for interlocal cooperation. They also noted that separate laws may govern partnerships between municipally owned small CWSs and private or community-owned small CWSs and partnerships that entail service contracting. As these laws affect the viability of agreements, further research that comprehensively evaluates each state's laws and, policies and programs is needed to evaluate the potential for partnerships within each state fully. Such research will allow comparison across states, thus lending greater insight into how state-enabling laws influence partnership formation.

In addition, while this research identifies the approaches to motivating partnership formation state capacity development coordinators think would be useful, further studies are needed to determine empirically which approaches have been most effective in catalyzing partnerships. As the details of specific policies vary, as does the context in which they are implemented, such an analysis should delve into detail regarding the design of the policies and programs as well as which forms

of partnerships they spark. Further research will necessarily need to examine the perspective of small CWSs, as they may differ from those of the state agencies that oversee them. Since small CWSs are not homogenous, knowledge regarding variation due to ownership, challenges faced, and other contextual factors will be relevant.

The complexity of formulating and enacting policies and programs to motivate partnership formation should be recognized. Some policies and programs may require legislative intervention, for example, policies that change statutory requirements and enable partnerships or policies that rely upon the distribution of funding from state coffers. Other approaches to motivating partnership formation may require promulgating new or revised regulations. Others can be directly implemented by state agencies under their existing authority. Except for some comments on the difficulty of enacting mandates, interviewees did not discuss in depth the policy-making process. Research is needed to identify which approaches to motivating partnership formation may be actionable given the political and institutional dynamics within each state and the efforts needed to adopt and implement policies and programs. This last point is particularly relevant to the transferability of these findings beyond the United States, as the process for developing and implementing policies and programs to encourage partnerships varies across countries.

8. Conclusion

Small CWSs face numerous challenges threatening their sustainability and ability to provide high-quality, reliable drinking water. Partnerships offer a promising avenue for small CWSs to enhance their capacity and resilience. However, partnerships come with drawbacks, and several barriers hinder their formation. Policymakers can play a role in catalyzing partnership formation by formulating and implementing policies that motivate partnership formation.

According to capacity development coordinators interviewed in this research, awareness building, incentives, and providing guidelines and templates are the most useful approaches to motivating partnership formation. However, the effectiveness of those approaches and the optimal design for each require further examination. No single approach to motivating partnership formation will address all the barriers and disadvantages associated with partnerships.

To best support small CWSs, policymakers and scholars alike must evaluate the potential of partnerships by differentiating between the varying forms of partnerships while considering the nuanced context of individual CWSs. Such a comprehensive evaluation will help determine when, under what circumstances, and which forms of partnerships are the most viable and beneficial solution, or if alternative approaches may better serve CWS. The urgent need to enhance the resilience and capacity of small CWSs is evident. Partnerships are a valuable option in the toolbox. However, policies advocating and encouraging partnerships must consider the nuanced aspects of water provision locally. By doing so, we can ensure that partnerships are appropriately utilized and maximize their potential to strengthen small CWSs.

CRediT authorship contribution statement

Anita Milman: Conceptualization, Methodology, Investigation, Formal analysis, Writing, Supervision, Funding acquisition, Project administration. **Olivia James:** Investigation, Formal analysis, Writing – Reviewing and Editing. **Cameron Macuch:** Investigation, Data curation.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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Appendix A. Supplementary data

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