RESEARCH SPOTLIGHT

All Hands on Deck

How Research Strengthens the Water Workforce

By Miriam Hacker, PhD, Research Manager, The Water Research Foundation

Water and wastewater infrastructure plays a crucial role in safeguarding public health, supporting economic development, and sustaining environmental balance. In the United States, drinking water is delivered by over 2.2 million miles of pipes, and wastewater is transported by over 800,000 miles of public sewers to advanced treatment facilities that manage and recycle wastewater (ASCE 2021a, b).

Behind every turn of the faucet, or flush of the toilet are water professionals working to ensure that critical water and wastewater infrastructure is designed, constructed, and maintained while effectively communicating and coordinating with other stakeholders and end users. The water workforce is always top of mind for the sector; since 2019, *"Aging Workforce,"* or anticipated retirements, has consistently been identified in the State of the Water Industry report as one of the top 10 challenges (Flancher 2022). Amongst turnover, utilities are having to pivot in response to evolving technology, digital transformation requiring new skillsets, increases in competition for employees, lack of awareness of water sector jobs, and changing cultural trends in how individuals value and engage with their work. As a result, water and wastewater utilities are looking to understand how to attract, train, and pay the water workforce.

This article focuses on the role that research plays in efforts to strengthen the water workforce. In order to collect and analyze data to inform what we know

THE Water Research FOUNDATION
advancing the science of water®

about water professionals and environment needed to sustain and support for our workforce, we need a high-level framework to help us organize the approach. Nuance is needed to help navigate the various aspects of workforce development and management efforts. Evaluating and advancing the social science of the water workforce will require strategic and incremental projects to advance our understanding and provide solutions for the sector.

Envisioning Workforce Trends Across the Water Sector

Right now, all aspects of workforce are important. This is an 'all hands on deck' moment in the sector; however, it can be challenging to prioritize where resources are needed when workforce is presented as a monolithic topic. A framework is shown in Figure 1 below to help organize the various aspects of the water workforce as they exist within an organization and across the sector as a whole. Each component of the framework is then explained, along with examples of how these aspects have been researched through The Water Research Foundation (WRF) and/or its partners.

Right now, all aspects of workforce are important. This is an 'all hands on deck' moment in the sector.

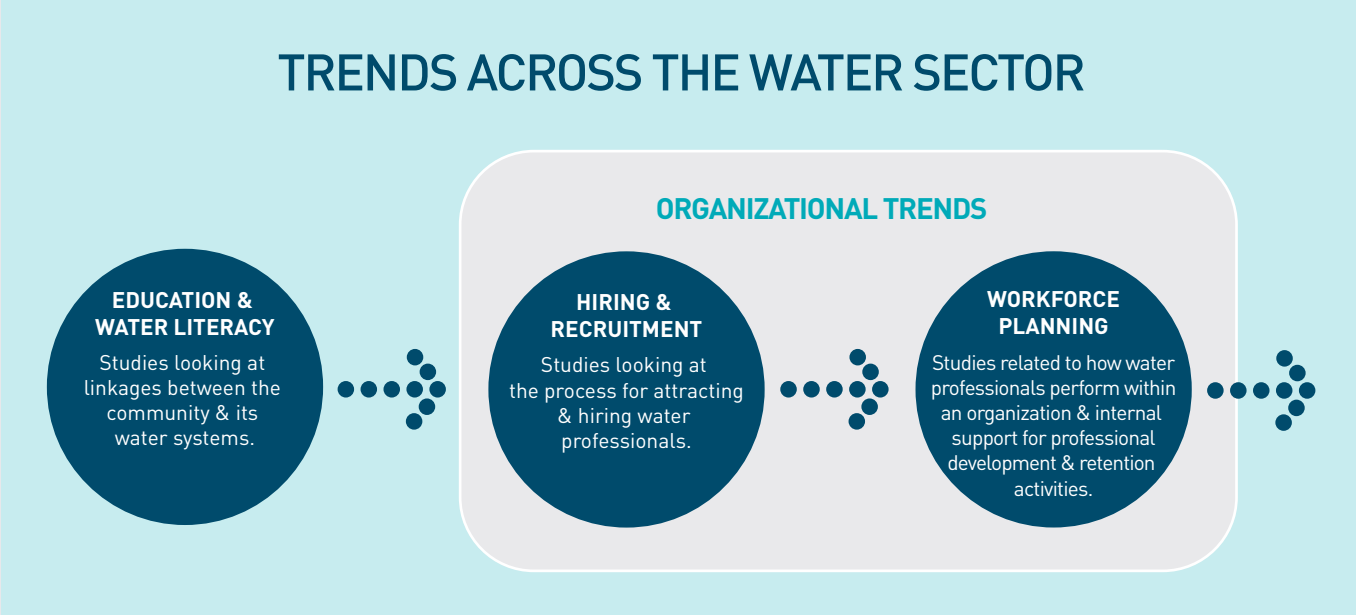


Figure 1. Overview of key dimensions for water workforce research.

Education, Water Literacy, & Community Engagement

- **Definition: Studies looking at the linkages between the community and its water systems.**

Literacy and awareness of local water systems has been shown to increase perception of environmental sustainability, as well as awareness of the water sector as a potential career path. This step is not intentionally designed to recruit individuals. In some cases, educational programs happen with early education and are used as a means of

building general awareness of local infrastructure and its operations. At WRF, this is driven by studies on public perception and outreach activities, for example, with desalination (WRF project 4481) and potable water reuse projects (WRF project 4979) (Eckl et al. 2023, Tennyson and Millan 2014).

Hiring & Recruitment

- **Definition: Studies looking at the process for attracting and hiring water professionals.**

Depending on the type of organization, there may be set procedures and regulatory requirements for hiring individuals. However, this category also looks at how organizations encourage applications for open positions. This might include career pipelines or pathways for specific groups, such as

higher education, veterans, previously incarcerated individuals, etc. WRF has provided unique perspectives to this area by looking at utilities and organizations that are working with diversity, equity, and inclusion programs to ensure that all community members see the water sector as a prospective career path (WRF project 5186). Another project is looking at the necessary skillsets as the water sector moves through a digital transformation and the role of data science in hiring (WRF project 5178).

Past research has looked at how organizations recruit and train operators (WRF project 4005), and WRF is in the process of studying organizations' capacity to develop recruitment programs (WRF project 5300). Openings in the water sector are not as frequently available as in other industries, which creates a challenge for timing and providing resources to recruitment programs. For example, one utility might have an operator position open once every decade and even this frequency is highly dependent on

RELATED WRF PROJECTS

Developing Curriculum and Content for DPR Operator Training (4772)
PI: Troy Walker, Hazen and Sawyer

Onsite Non-Potable Water System: Guidance Manual and Training Modules (4909)
PI: Brian Pecson, Trussell Technologies, Inc.

Development of an Operation and Maintenance Plan and Training and Certification for Direct Potable Reuse (DPR) Systems (1707)
PI: Troy Walker, Hazen and Sawyer

Organizational Development Needed to Implement a Knowledge Management Strategy at Water Utilities (4003)
PI: David Bennet, Mountain Quest Institute

Workforce Planning for Water Utilities – Successful Recruiting, Training, and Retaining Operators and Engineers to Meet Future Challenges (4005)
PI: Alan Manning, EMC, Inc.

Renewing the Water Workforce: Improving Water Infrastructure and Creating a Pipeline to Opportunity (4751)
PI: Joseph Kane, Brookings Institute

Succession Planning for a Vital Workforce in the Information Age (2850)
PI: John Voeller, Black and Veatch

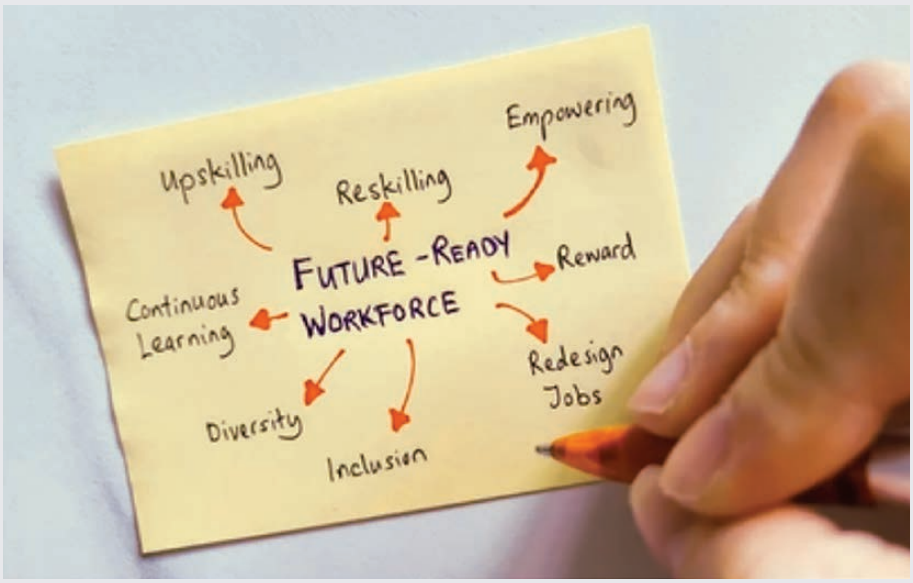
Development of a Public Communication Toolbox for Desalination Projects (4481)
PI: Mark Millan, Data Instincts and Patricia Tennyson, Katz & Associates

geographic location, organizational size and annual budget. This has spurred the investigation of collective efforts to attract talented individuals to the sector through regional workforce collaboratives (WRF project 5238).

Workforce Planning

- **Definition: Studies related to how water professionals perform within an organization and internal support for professional development and retention activities.**

Hiring is just the beginning of a water professional's experience in the organization. The bulk of research lies in workforce planning which focuses on enabling the environment for an individual to feel supported through training, professional development, and knowledge exchange. Understanding metrics for success, or how to evaluate the performance of programs and professionals in an organization, can inform pain points or highlight effectiveness of initiatives to increase desired outcomes. In some cases, this might look at employee satisfaction, turnover, competencies,



capacity threshold, or other indicators. A recent report from the Brooking Institute highlighted trends in some of these key indicators across the sector (WRF project 4751).

Retention and knowledge management are the primary goals for planning efforts. For example, past work has identified career progression as a resource for helping individuals see themselves in the water sector as a career rather than a job (WRF project 4005). WRF is currently exploring what progression pathways look like in more detail (WRF project 5284) and the diverse ways these programs are facilitated at an organizational level (WRF project 5307). Other retention efforts might include mentorship programs, involvement in service groups/activities, and training opportunities to improve expertise.

RELATED WRF PROJECTS

Potable Reuse Demonstration Design & Communication Toolbox (4979)
PI: Eric Eckl, Water Words that Work

Preparing the Water Sector to Embrace Technology: Skillsets and Enterprise Management Approaches for the Digital Age (5178)
PI: Prabhushankar Chandrasekeran, Arcadis

Diversity, Equity, and Inclusion Best Practices for the Water Sector Workforce (5186)
PI: Katie Porter, Brown and Caldwell

Best Practices to Attract and Retain a Skilled & Diverse Water Workforce: Regional Workforce Initiatives (5238)
PI: Ruthie Redmond, US Water Alliance

Exploring Career Pathways of Diverse and Inclusive Utility Leadership (5284)
PI: Alford Young, Jr., University of Michigan

Recognizing Institutional and Organizational Capacity for Effective Workforce Development Programs (5300)

Investigating Progression Pathways Across the Water Workforce (5307)

Supporting water professionals through training and professional development are evolving needs in the sector, including the acceleration of innovation and intelligent water systems. For example, with the increased number of water reuse projects, studies have been done to understand core competencies and training needs to ensure operators feel supported in their work with water reuse systems (WRF projects 1707, 4772, 4909). These studies can also look at the effectiveness of training programs, like apprenticeships or certification programs that organizations utilize.

Finally, management and transfer of institutional knowledge is an indirect impact of workforce planning. Concerns exist that as people transition to retirement or to other parts of the sector, the expertise and understanding that has been gained will transition with them. Documentation and the exchange of information across an organization can support training and retention efforts. Some examples of this include succession planning (WRF project 2850) and formal knowledge management programs as part of an organizational culture (WRF project 4003).

Scale of Assessment

The majority of research has focused on analysis and recommendations at the organizational level. However, recent work has emphasized the importance of different scales of analysis (Kane and Tomer 2018). Departure from an organization does not necessarily mean departure from the water sector. Different scales of analysis might include the following:

- **Organizational:** within or across departments
- **Cross-organizational:** including multiple organizations, including regional or state-level analyses
- **National:** analyses across multiple states and possibly sectors

Efforts are being made across the public, private, and nonprofit sectors to increase the number of professionals in the water workforce, including

Concerns exist that as people transition to retirement or to other parts of the sector, the expertise and understanding that has been gained will transition with them.

efforts through the federal government to highlight career pathways (USEPA 2023), and aspirational directions needed for the human infrastructure to match the needs of the industry (U.S. Water Alliance 2024).

Research as a Resource for the Water Workforce

This article is intended to provide a framework for how we talk about research needs for the water workforce, as well as examples from existing work at WRF. In many cases, research has focused on multiple workforce aspects, attempting to cover recruitment, retention, and training in one project. These high-level efforts are needed and could also benefit from more incremental work to provide sufficient nuance to each of these dimensions.

There are also some key areas that would benefit from further investigation, including:

- Education and its linkages to points of entry to the workforce
- Effective messaging for hiring and recruiting from diverse audiences
- Data-centered approach to evaluating and assessing workforce needs
- The role of data science in workforce programs

WRF is positioned to advance what we know about the water workforce to help support organizations actively engaged in this work. It will take collaborative partnerships to further increase this domain of knowledge in a way that ensures our critical infrastructure continues to be supported through water professionals.

MORE INFORMATION

6666 West Quincy Avenue
Denver, CO 80235-3098

1199 North Fairfax Street,
Suite 900
Alexandria, VA 22314-1445

www.waterrf.org
info@waterrf.org

REFERENCES

ASCE (American Society of Civil Engineers). 2021a. "Wastewater." ASCE's 2021 Infrastructure Report Card for America's Infrastructure. https://infrastructurereportcard.org/cat-item/wastewater-infrastructure/.

ASCE (American Society of Civil Engineers). 2021b. "Drinking Water." ASCE's 2021 Infrastructure Report Card for America's Infrastructure. https://infrastructurereportcard.org/cat-item/drinking-water-infrastructure/.

Flancher, D. 2022. "State of the Water Industry: Workforce, Water Supply, Infrastructure Among Top Concerns." J AWWA, 114: 74-77. https://doi.org/10.1002/awwa.1924.

Eckl, E., C. Brown, R. Bielobocky, C. Del Boccio, and T. Richardson. 2023. *Purified Recycled Water Demonstration Design & Reuse Communication Toolbox*. Project 4979. Denver, CO: The Water Research Foundation. https://www.waterrf.org/research/projects/potable-reuse-demonstration-design-communication-toolbox.

Tennyson, P. and M. Millan. 2014. *Development of a Public Communication Toolbox for Desalination Projects*. Project 4481. Denver, CO: The Water Research Foundation. https://www.waterrf.org/resource/development-public-communication-toolbox-desalination-projects.

Kane, J. and A. Tomer. 2018. "Renewing the Water Workforce," Washington, D.C., Brookings Institute. https://www.brookings.edu/wp-content/uploads/2018/06/brookings-metro-renewing-the-water-workforce-june-2018.pdf.

USEPA (United Sates Environmental Protection Agency). 2023. "America's Water Sector Workforce Initiative." https://www.epa.gov/sustainable-water-infrastructure/americas-water-sector-workforce-initiative.

U.S. Water Alliance. 2024. "Toward a Strong and Equitable Water Workforce." Washington, D.C: U.S. Water Alliance. https://uswateralliance.org/resources/toward-a-strong-and-equitable-water-workforce/.