The Takeaway

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Desalination plant Carlsbad, California

Public-Private Partnerships in the Water Sector

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Public-private partnerships (PPPs) have grown in popularity as a method to leverage private-sector actors in the production of government services. With the global challenge of water insecurity, PPPs are becoming more common for large-scale water infrastructure projects such as desalination. Desalination facilities are complex and expensive operations, which means that understanding the appropriate context for PPPs is increasingly important.

Traditionally, governments fund the cost of new water infrastructure by issuing debt and repaying that debt with water fees and taxes. The rising costs of infrastructure, increasing water scarcity, and financial constraints of governments have led to the consideration of non-traditional financial innovations, one of which is public-private partnerships (PPPs). While PPPs are most commonly used for housing and transportation infrastructure, state and local governments are in-

WHAT'S THE TAKEAWAY?

PPPs shift costs and risks of desalination facilities between public and private sector partners.

PPP structures differ across regions based on the needs and risk preferences of communities.

Whether PPPs should be used, should be based on how much public entities want to shift the financial risks and control of core public assets to private organizations.

PPPs are not a "one size fits all" solution and may not be appropriate in every scenario.

creasingly turning toward PPPs to offset the high cost of desalination stemming from both facility construction and maintenance.

To understand how different PPP arrangements are used in the water sector, a team of researchers at Texas A&M University examined the global desalination sector and select cities around the world using PPPs for desalination.[1] This brief summarizes what they learned about how risks are shared between the private and public sector, how those risks vary globally, and current trends in water infrastructure finance.

DESALINATION

Desalination is a growing industry around the world as arid regions with water scarcity concerns seek alternative sources for water. The desalination process removes salts and minerals from seawater and brackish water, making otherwise unusable water drinkable. However, the process is costly, energy intensive, and requires specialized knowledge. In 1996, there were only 92 plants globally mostly located in the Middle East. Today, due to technological advances that make the process more accessible, there are more than 15,000 plants worldwide.

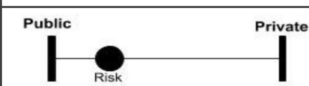
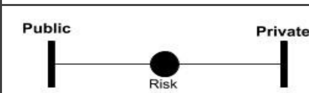
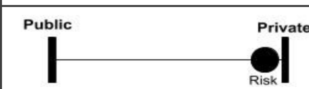
PUBLIC-PRIVATE PARTNERSHIPS

Public-private partnerships are joint arrangements between the public and private sector to work toward a common goal while sharing the risks, resources, and liabilities of the projects. Depending on the model, the contracts transfer various risks and responsibilities from public agencies to private firms. A key risk factor for water infrastructure is demand and revenue. Common PPP structures and their level of transferred financial risk are shown in Table 1. PPPs also have shifts in equity, affordability, access, and sustainability of water infrastructure—which may or may not benefit the public. These shifts have largely been unstudied in the PPP context, especially in the water sector.

PPP TRENDS IN DESALINATION

The most common PPPs in the desalination industry are Build-Own-Operate (BOO) and Build -Operate-Transfer (BOT) arrangements, but PPP structures tend to vary by geographic region. The BOT model is most prominent in the Middle East and North Africa; Design-Build (DB) is most common in North America; and Design-Build-Operate (DBO) is preferred in Western Europe and East Asia.

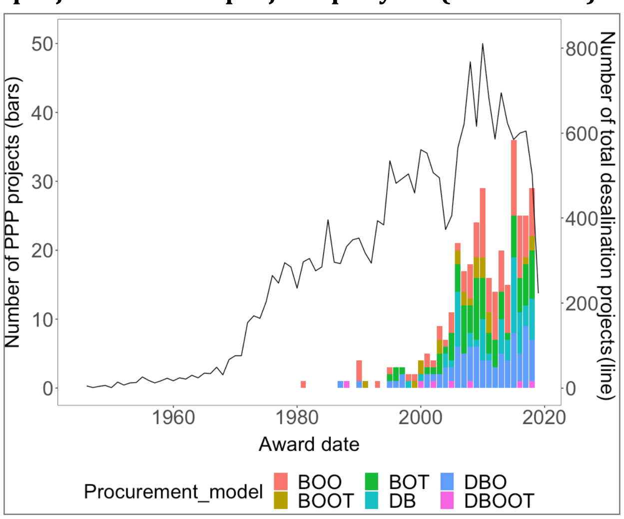
Table 1: Public Private Partnership Forms and Revenue Risk Transfers

Type	Description	Financial Risk Transfer
Design-Build (DB)	Design and construction phases are combined into one fixed-fee contract.	
Design-Build-Operate (DBO)	Public entity owns and finances the construction, but the private entity designs, builds, and operates the asset to an agreed upon level of output.	
Build-Operate-Transfer (BOT)	Private entity is responsible for the design, construction, operation, and maintenance of the facility for a specified time.	
Build-Own-Operate (BOO)	The private partner owns the facility and is assigned all operating revenue risk and any surplus revenues for the life of the facility.	

Note: Figure modified from Page et al. (2008) incorporating information from Algarni, Arditi, & Polat (2007) and the authors' own observations.

Using global desalination data we find that 2.7% of all desalination projects use some PPP arrangement, which is similar to large scale infrastructure projects in other sectors. The significant growth in the use of PPPs, especially since 2000 (as shown in Figure 1), also follows the overall trend of infrastructure projects exploring partnerships during that time. Most frequently, PPPs were used for large projects—approximately 30% of extra-large projects (producing 50,000 m^3/day or more of desalinated water) and 12% of large projects use PPPs, compared to only 2% of medium projects. PPPs are also more common for seawater desalination than other types of desalination. Municipalities are the most common government entity to use PPPs for desalination projects.

Figure 1: The total number of all desalination projects and PPP projects per year (1945-2019)



Source: Author's calculations based on data from Global Water Intelligence's www.DesalData.com

CASE STUDIES

For a more in-depth look at how PPPs are used in different countries, the Texas A&M research team conducted case studies in several countries around the world. The selected sites were in semi-arid regions that adopted desalination early and face water scarcity challenges due to climate change and population growth, but differ in their institutional governance models for water. Israel, for example, has highly centralized governance. The state owns all the country's water and has authority in deciding where the next facility will be built and for soliciting bids from private corporations. In their PPP deals, they prefer the BOT model, and water is purchased by the state at a fixed amount even if it is not needed immediately. This has the benefit of increased revenue stability for the private sector partner and gives more of an incentive for facilities to remain operational all year long. After 25 years of ownership, the facility is transferred back to the government which then has the option to enter into a new contract with a private entity for operation.

The most decentralized and fragmented institutional arrangement of the case sites is the Carlsbad facility in southern California. This facility has a DBO arrangement where water from the plant is purchased by the San Diego County Water Authority (SDCWA), which is an independent water authority. SDCWA then sells water to cities. Similar to Israel, the SDCWA contract guarantees a minimum level of water they will purchase from the private company. But, the DBO model ensures that the SDCWA does not have any liability or financial risk in the design. After ten years, SDCWA can assume ownership of the plant. Institutional arrangements of this type add additional layers of political and financial risk for both public and private partners.

CONCLUSION

The decision to use a PPP for large-scale water infrastructure such as desalination depends on specific goals, operating environment, and risk levels. The cases demonstrate different methods of sharing risks and responsibilities in the construction and maintenance of water infrastructure. The institutional arrangements range from highly centralized funding and negotiating power at the national level as in Israel, to highly decentralized and fragmented where the role of local governments greatly increases as in California. These varying institutional arrangements and country-specific laws influence the types of PPP arrangements that are likely to be implemented. Despite the potential benefits of PPPs in the desalination sector, some potential downsides include the possibility of a high total cost, financial risks from debt and default, and political risks from public perceptions. There also may be obstacles to establishing partnerships initially, legal hurdles, and regulatory barriers. Establishing PPPs can be difficult due to the need for public support and special legislation. An enabling regulatory, legal, and political environment is necessary for success.

Ultimately, whether or not a public-private partnership is a good fit for a particular project depends on the amount of risk the public and private sector are willing to accept for the project. A variety of risk factors exist including environmental, political, and financial, which are likely to be case specific depending on geography, water scarcity, political will, and fiscal health. Currently, PPPs in water infrastructure are understudied. More research is needed in order for government leaders to make informed decisions about PPPs and new water infrastructure, including research on what models of PPPs are most successful and how geographic regions influence model success. By understanding the risks and benefits of each PPP model, municipalities and governments can determine what model will have the most efficient and equitable outcome.

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Notes:

[1] Greer, R.A., Lee, K., Fencl, A. & Sneegas, G. (2021). *Public-Private Partnerships in the Water Sector: The Case of Desalination*. Texas A&M University working paper.