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DISPARITIES IN URBAN INFRASTRUCTURE

- Regional implications of BREXIT
- Social entrepreneurship

WHAT NOW? AN OVERVIEW OF URBAN WATER INFRASTRUCTURE IN THE USA

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Introduction

Urban water infrastructure (UWI) is a critical component of improving the quality of life and prosperity for regions all over the world. Urbanisation leads to the spatial concentration of the demand for water and the need for its treatment which can quickly surpass the capacities of the natural world. While cities' demands exhaust the capacities of the natural world, urban areas represent a high concentration of economic and political power, which can be exercised to create and manage UWI to provide water services when the natural world cannot (Bettencourt, 2007). However, UWI in many areas is facing growing pressures from uncertain climatic conditions, degradation due to ageing, and challenges associated with urban growth or decline.

The State of Urban Water Infrastructure

Water infrastructure is a prerequisite for urban social and economic prosperity, and the need to maintain and expand its services will continue to grow. The percentage of the United States population living in urban areas has increased from 34% in 1960 to 54% in 2014. This dramatic increase has significant impacts for how and how much water cities will supply, treat, and manage.

Today, UWI in the United States is at a point of transition. The nation has a vast network of legacy systems that continue to meet essential urban water needs. However, the old paradigm of developing water systems is outdated. As urban areas in the United States (and most of the western world) developed, water had little value to the development process. Water for supply was imported from remote environments, used once, treated and exported back to the remote environment. Stormwater systems were developed to rush the water off the land as quickly as possible, and streams in the urban area were often buried and discharged downstream of the urban area. This practice has left the remote environments with either too little water or too many pollutants, and the urban area subject to flooding, droughts and increased temperatures due to heat island effects.

Water tower used to pressurize a water supply system, Fort Collins, Colorado, USA. © Alexander Maas

Climate change and urban growth have created a need to revisit the relationship of water and the city. Historically, investments in urban water infrastructure were rarely aimed at capturing the resource of stormwater or reusing water already in the urban environment. Due to path dependencies in urban development, many cities now have limited options to develop stormwater and reuse systems despite their obvious benefits. Nevertheless, there is growing awareness that water and waterways can be developed as urban amenities in greenways, water features, green roofs and other systems that increase liveability in the urban environment. In addition to the physical limitations created by existing infrastructure, progressive UWI development is also inhibited by antecedent institutions. Due to the fact that urban water systems developed in phases, their institutional framework is "siloed" such that UWI is often separated into distinct services that are managed independently. These services primarily include water supply, wastewater, and stormwater.

Divisions and Categories of Water Infrastructure

Water supply services require considerable treatment and conveyance infrastructure to meet or exceed standards set forth by the US Environmental Protection Agency, which focus on eliminating threats from microbial and chemical contamination. Chemical contaminants are removed through a process of coagulation and flocculation, sedimentation and filtration. Pathogens are removed through a disinfection process like chlorine contact or UV exposure. Once water has been treated to (or above) safe drinking water standards, it is piped to homes and businesses through extensive distribution systems.

Most supply water used in buildings is returned to a treatment facility via sewer systems at which point it is classified as wastewater. Wastewater, like water supply, is also generally comprised of treatment and distributions systems. They are normally operated by cities or special districts, comprising collection and treatment infrastructures. The purpose of wastewater treatment is to reduce

Settling tank in water treatment plant. © American Water Works Association, All Rights Reserved

pollutants (oil, soaps, human waste, etc.) to levels that are not overly detrimental to natural systems or users downstream. Technologies used for this process vary but they usually entail aeration, removing sludge and scum, and killing bacteria.

Stormwater is the least-organised of the water services, and offers many opportunities for innovation. Its primary purpose is to protect life and property, with a secondary goal of reducing harmful contamination to the environment or other water sources. The many impermeable surfaces in cities lead to significant run-off during precipitation events which can cause flooding and transport pollutants. Whereas drinking water and wastewater systems are normally considered as utility services, storm water provides public goods for entire areas as well as benefits to individual properties.

Financing and Funding Water Infrastructure

While effective water infrastructure is a prerequisite for urban social and economic prosperity, recent investments have been insufficient in maintaining and expanding these systems. A recent report by the American Water Works Association anticipates a trillion dollars in water infrastructure investments is needed over the next 25 years in order to maintain current levels of service (AWWA, 2012).

Historically, water infrastructure projects have been funded in a pay-for-service model where individual households or businesses pay a fixed charge and a per gallon charge for water used. Some portion of indoor water use is estimated to enter the sewer system, such that wastewater bills can be--and often are--separated from supply charges. Stormwater funding sources have been less consistent because of controversies over using a utility model to charge for services. Generally speaking, stormwater systems are funded through fees based on the footprint of a property, a flat rate, or property taxes.

In the US, these services are usually separated either within a given city department as enterprises or externally as different utilities. The resulting siloing of UWI creation and management is viewed as a source of inefficiency, since possible synergies exist between water services. For example, storm water infrastructure may include investments in infiltration, which will help groundwater recharge and drinking water supplies. Yet, funds designated for water supply can rarely be used in the creation of the infiltration project. The "One Water" movement acknowledges the interconnectedness of each water service not only with each other, but also with urban design, liveability, and welfare. Given the significant investments necessary to maintain and expand service, many believe that there is an opportunity to push UWI and management towards this One Water approach.

Funding water infrastructure and services can be complicated due to social and distributional concerns (Scanlon et al, 2004), large upfront costs, regulation, demographic changes, and economic externalities. These characteristics and a general lack of appetite for public spending has led to delayed or deferred investments in UWI, such that 22% of water mainlines are more than 50 years old (Folkman, 2012). While experts agree that significant investments in UWI will be necessary over the next few decades, the methods for funding them is less clear.

Just as we are entering an era of One Water solutions, there has also been a push to create public-private partnerships (PPP). These partnerships range from issuing bonds (the most traditional funding source) to affermages to concessionaries, which compensate third parties to invest in and operate specific water assets. The key benefit of PPP is the decreased need for direct capital expenditure from governments or public utilities. Some also argue that private partnerships will improve service provision while decreasing costs, although there is little evidence to support this claim (Walter et al., 2009).

Conclusion

As communities struggle with replacing and renewing existing infrastructure while meeting water demands, the opportunity to innovate water services must be considered. The existing method of fractured governance systems, centralized service delivery, and traditional infrastructure is expensive and inefficient. Innovative and holistic water infrastructure and management may strengthen the resiliency of service delivery while providing additional socio-economic benefits. The current financial and regulatory systems are not well positioned to consider these innovations and change will need to be considered to meet the needs of future challenges.

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The Voice of the Membership

One of the biggest issues facing citizens in countries worldwide is lack of affordable access to water. Although the lack of access to water services is more critical in a developing world context, the lack of affordable water services is unfortunately an issue for low-income citizens in the developed world. Privatization has been offered as a solution to the rising costs of providing water services but the switch to private water is not necessarily beneficial to customers. Integrated "one water" management ideas have been offered as a means of integrating the provision of water services to enhance efficiency and realize the co-benefits of preserving water resources. The challenge of providing billions of people with affordable service is not limited to water, but also includes invisible telecommunications infrastructure. Here the geographic situation and topography of place are key drivers of infrastructure costs.

In the future, several factors including population size and climate change will place pressures on urban infrastructure systems. Our *Regional Survey*, edited by Guest Editor, Elizabeth Mack, Michigan State University, USA presents some of the debates and solutions surrounding the provision of water and telecommunications services to people around the globe.

Following the triggering by the UK of Article 50 of the European Union, one of the RSA's experts on manufacturing, David Bailey, shares his views on the implications of different types of deals on Brexit for the UK car manufacturing industry and jobs therein.

Our *In Depth* article by Matthias Fink, Richard Lang and Ralph Richter examines social entrepreneurship in four case-study regions of Europe and the implications for economic and social development in rural areas.

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