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Future of urban water and wastewater management: views on Singapore International Water Week

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In March 2006, Khoo Teng Chye, then Chief Executive of PUB, the National Water Agency of Singapore, and some of his senior staff members visited Mexico City. Over a leisurely business breakfast, the discussion primarily focused on what could be done to make Singapore a leading global hub for knowledge, information and innovation in the area of urban water and wastewater management.

There is no question that in 2006 such a city with specialized knowledge and expertise in urban water and wastewater did not exist anywhere in the world. Our view was that not only did such a city not exist, but also Singapore could become a leading global centre within a few short years, especially as the city-state already had the knowledge, capacity and international credibility on urban water and wastewater management.

Our suggestion to the Singaporean visiting team was to consider a three-pronged approach. First, to provide private sector companies and international organizations appropriate incentives to relocate some of their water-related current activities to Singapore and to encourage them to establish new water-related activities. This would also provide a good environment for new start-ups to consider Singapore for their business.

Second, the city-state should concurrently consider organizing a regular Singapore International Water Week (SIWW) and exhibition which would showcase its achievements and extensive expertise. Unlike other international water meetings, SIWW should focus exclusively on urban water and wastewater management, a topic on which Singapore was an acknowledged world leader. Also, and equally important, SIWW should have a clear focus on water utilities and water-related businesses. Discussions should be on application and use of the knowledge to solve real-world urban water and wastewater problems (Biswas, 2013). It should actively encourage discussions of ‘best-in-class’ solutions from anywhere in the world which could be adopted in many other cities with appropriate modifications to account for local conditions. It should refrain from ‘SOS’ (same old stuff) discussions which other conferences are replete with. It should bring water utilities, businesses, including consulting groups, technology and service providers, investment communities and international

organizations together to discuss current and future problems and their implementable solutions.

Third, Singapore should consider establishing an institute for water policy on solving urban water and wastewater issues of the present and the future.

Mr Khoo and his staff endorsed these ideas enthusiastically. True to Singapore's style of supreme policy-making efficiency, these ideas were all promptly implemented. The first SIWW was organized in 2008.

The latest SIWW was held in July 2021. Because of COVID-19 restrictions, this year both SIWW and the exhibition were held virtually.

A dozen years after SIWW was launched, it is time to take stock as to how SIWW has developed and performed based on our original discussion in Mexico City some 15 years ago. Based on any criteria, SIWW has been a remarkable success. Naturally, over the years, it has evolved, but this evolution has been positive. For example, since 2012, this annual event became biennial. During the intervening years, SIWW decided to organize Spotlight with a few hundreds of specially invited experts from water utilities, businesses and academia. The focus has remained firmly on urban water and wastewater issues. Unlike all other major water forums, discussions have remained firmly grounded on the application of knowledge to solve real-world problems. It is now probably the only international forum where one learns about the first-in-class practices developed in different parts of the world on all aspects of urban water and wastewater solutions that actually work, that have been implemented, and that objectively assess the enabling conditions that allowed their successful implementation.

The exhibition has effectively complemented the technical discussions. As one Indian water minister commented to us during an earlier SIWW, the exhibition had saved him considerable time and effort since he was trying to find out what types of membranes would best suit his purposes. He was delighted to meet with Chinese, European, Japanese, Korean and North American membrane manufactures and service providers, all under one roof, within only three days of his stay in Singapore. This is in addition to all the new knowledge he garnered that could be applied to solve his problems. In his words, 'SIWW is a first class one-stop shopping centre for implementable knowledge, experience and technology'.

SIWW has led the way to show there is no one universal solution for every water problem of the world and also for all times. For urban water and wastewater problems, solutions are often city- and time-specific.

An analysis of this year's SIWW would indicate its specialized knowledge generation,

dissemination and utilization character. In this brief article, we discuss only three of the many issues that impressed us from the sessions in which we participated.

First, a good example of best-in-class knowledge generation in this year's SIWW came from the Phnom Penh Water Supply Authority (PPWSA). This public water utility has developed management capacity, leadership at all levels and a very successful business model, as a result of which every person in Phnom Penh, rich or poor, has access to clean water, which can be drunk safely from the tap. An impressive fact that any observant visitor to the PPWSA will notice is that everyone in the utility drinks water from the tap. Many of its performance indicators are significantly better than water utilities in London, Paris or New York. Yet, in 1993, the PPWSA was nearly bankrupt, and its unaccounted-for-water was 73%. The PPWSA does not receive a single rial from any level of government. Its consumers pay for the water they use. Poor households receive targeted subsidies. During a special session at SIWW, the enabling environment which allowed Phnom Penh to undergo this remarkable transformation was assessed. The question that arises is if Phnom Penh, with all its constraints, could solve its urban water supply problems within 15 years on a sustainable and equitable basis, why other cities such as Delhi, Jakarta, Lagos, Cairo or Buenos Aires have not managed to do so, even though they have had more resources, better capacities and a thriving private sector to which many tasks could be outsourced (Biswas et al., 2021). Also worth noting is that the PPWSA has not only revolutionized access to clean water supply to a steadily increasing municipal boundary, but also effectively impacted on the policies of its main supporters such as the Japan International Cooperation Agency (JICA).

Second, a very interesting discussion during the event was how industrial water uses can be approached in a holistic and out-of-the-box manner. Very few water conferences discuss seriously industrial water uses. Even when they do, the focus is on how to make such uses more efficient. In contrast, a SIWW session focused on the water risks of industries. Water is as important to industry as energy, raw materials and data. Industry will have to consider four types of water-related risks.

First is physical water scarcity. When Brazil had a severe drought in 2015, General Motors found that its water costs increased by US\$2.1 million. Since the majority share of electricity in Brazil is generated by hydropower and the drought reduced reservoir levels significantly, electricity cost went up by another US\$5.9 million.

Second is regulatory risks. In 2015, Chinese regulators mandated paper manufactures should reduce water consumption by 10%. Chenming Group, the biggest paper manufacturer in China and one of the world's top 10, was forced to assess its water-use practices. By redesigning and upgrading its manufacturing processes, Chenming reduced its water requirements by 45%.

Third is reputational risk. When Nestlé decided to use an appropriate shadow price for water, it found that it made good financial sense to make some of its manufacturing plants water neutral by extracting water from one of its raw materials: milk. Milk contains 87% water. Earlier, this water was simply evaporated when making condensed and powdered milk. At present, in several of its factories, this evaporated water is collected, condensed, treated and used. It now provides the entire water requirements of its milk factories. Factories in Lagos de Moreno, Mexico; Mossel Bay, South Africa; Qingdao, China; and Modesto, California, have become ‘zero water’ plants. In fact, during a recent drought, its Mexico factory sold excess water to a nearby factory in this very arid region.

Fourth is stakeholders’ risk. With increasing interests of shareholders on companies’ environmental, social and governance (ESG) performances, the pressure is on their chief executive officers (CEOs) to reduce their water consumption as well. Larry Fink, CEO of Blackrock, which manages assets worth US\$7 trillion, wrote to all CEOs of companies in which it has shares: ‘What happens to inflation, and in turn to interest rates, if the cost of food climbs from drought and flooding?’

A third important message that came out from SIWW is that the future for water utilities is going to be increasingly complex. It will not be enough to consider issues such as water adequacy, resilience and sustainability, though these will continue to be important factors. In addition, it will be essential to make sure that water utilities are carbon neutral by 2060, if not earlier. It will be necessary to see how renewable energy can be used to meet the energy needs of water utilities. PUB and a few other utilities are already making determined attempts to use reservoir surfaces to generate solar energy as well as harvest energy from wastewater. However, this may not be enough. Utilities may have to consider other options such as carbon capture so that they become carbon neutral, even positive, within the next three to four decades. In addition, they will have to develop new business models, have broader mindsets and significantly advance adaptive capacities to incorporate new management practices, technological developments, gauge the changing attitudes and perceptions of society, and make appropriate and timely changes. The era of boring and slow-moving water utilities is over. Also, as utilities enthusiastically enter the digital era, they have to ensure cyber security of water and wastewater treatment works. The frequency of known cyber-attacks on water utilities has consistently increased since 2000. Cyber security is likely to be an increasing concern in the coming decades.

Unlike other global water conferences, SIWW 2021 came out with many new ideas as well as examples of good implementable and replicable practices from leading water utilities of the world and also unknown and unsung heroes from the developing world, such as Phnom Penh.

There is no question that SIWW has now come of age and become the leading global event

for urban water and wastewater management. It has been remarkably successful in bringing useful and actionable knowledge. What is now necessary is for SIWW to find effective ways to synthesize and disseminate further all this collective knowledge generated during the event, so that water professionals and policy makers who cannot participate become aware of it and consider adapting it to solve their own urban water and wastewater problems.

Some 2500 years ago, Chinese philosopher Confucius said, ‘The essence of knowledge is having it, to apply it.’ As we approach the second quarter of the 21st century, our view is that knowledge has four components: generation, synthesis, dissemination and application. SIWW is doing a splendid work in terms of knowledge generation, certainly significantly better than all other international water fora. It should now consider other complementary phases. SIWW will make a real contribution to the world’s urban water security if it can synthesize the new information that comes out from its week-long deliberations and then disseminate it extensively all over the world. Not even one global water congress is systematically contributing to knowledge generation, let alone knowledge synthesis and dissemination. Only when generated knowledge is synthesized and disseminated effectively will policy makers and water professionals be able to learn about it and apply it to solve their urban and wastewater water problems. It will further separate SIWW from the crowd.

The current issue of the journal contains several papers. Li et al. (2020) discuss the remarkable success of the Three Gorges Project in transferring goods transportation from roads to inland navigation. This is not only significantly reducing the cost of transportation but also contributing to major reduction in carbon emissions. Gong et al. (2020) assess livelihood resilience after the development of an important reservoir in Qianping, China. López-Ruiz et al. (2020) discuss the acceptance of direct potable water reuse for domestic purposes from southern Spain. Mesta et al. (2020) suggest alternative solutions for a long period of missing streamflow data, and Annys et al. (2020) outline Ethiopian experience in expanding small-scale irrigation expansion along the Tekeze River. McNamara et al. (2020) outline how models were effectively used to plan irrigation development in a drought-prone region of southern Chile. Finally, Molinos-Senante and Maziotis (2020) review drivers of profitability and produce in the English and Welsh water industry since their privatization in 1959.

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