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EDITORIAL

Reimagining water management

When one reads any major national media anywhere in the world, it is very likely that there would be at least one article most days on extreme droughts and floods, heatwaves, wildfires, sea level rise, or on climate change. All these issues are directly related to water in one way or another. Furthermore, putting 'water crisis' into Google, on 31 May, would have brought 570 million results.

While the discussions of global and national water crises have been a real growth industry in recent years and it may likely even accelerate in the coming years, the fact remains the world is not facing a water crisis because of actual physical scarcity of this natural resource but because of its poor management over the centuries. If water is properly managed, the world has enough water not only for now but also for 2100 when the global population will be higher than what it is currently, and economic activities will be much greater. Furthermore, we currently have the necessary knowledge, technology, management expertise and financing to manage water significantly better to avert future crises. Also, as knowledge and technology advance rapidly in the coming decades, the water profession will have many more ways in which to manage this resource immensely better. Thus, unlike the prevailing overwhelming pessimistic view, we are cautiously optimistic about the world's water future.

In this Editorial, we would like to share our views as to some of the challenges water management is facing and likely to face in the coming years, and how these could be resolved.

Water not high up on global or national political agendas

While water issues, especially water-related crises, including scarcity and pollution, have received increasing attention in recent years, managing water efficiently and equitably, on a long-term basis, has not had sustained attention from politicians, nationally or internationally. The only time water issues become a priority political consideration is when there is a prolonged drought or a heavy flood in their areas. As soon as the extreme floods or droughts are over, almost all politicians' interest in water evaporates and water promptly disappears from the political agenda (Biswas, 2019; Biswas & Tortajada, 2023).

Efficient and equitable water management is a long-term process. It cannot simply be achieved if political interests in water exist for one to five years. Proper water management requires decades of sustained political interest, good planning and proper funding so that appropriate policies and plans can be formulated and properly implemented over a much longer time frame.

Formulations of policies and plans are not enough. For example, India formulated its first National Water Policy in 1987. It was reviewed and updated in 2002 and 2012. Another update was attempted in 2022, but its relevance left much to be desired, so

much so that two members of the committee who were preparing it decided to resign. At some stage the country will have to do a new, realistic and future-oriented fourth version of this policy. The sad part is none of the three versions prepared earlier was realistic and implementable. They were basically feel-good documents, parts of which are totally unimplementable under the Indian conditions (Pandit & Biswas, 2019). Not surprisingly, the impacts of all three versions of the policy on India's water management have been mostly invisible.

Any water policy must be future-oriented, and there should be sustained political interest so that it can be implemented properly in a timely manner. Plans should be regularly monitored and evaluated, and also updated every four to five years. This is because many conditions in the countries, on the basis of which the plans were initially formulated, would have changed, as well as political priorities and people's attitudes to and perceptions of various factors on which the plans were originally based. In addition, scientific and technological developments and management practices will have changed and should be considered during the revision processes.

The following are several reasons why water policies and plans should be reviewed regularly.

First is the changing population structure of countries, at both national and subnational levels. Countries like South Korea, Japan, Singapore, Spain and Italy are facing major structural problems in terms of negative population growth and their impacts. Fertility rates in these countries are below the replacement level of 2.1. In South Korea, the fertility level, in 2022, fell to the lowest ever observed in any country, at 0.78. Japan, Singapore, Spain and Italy, in 2022, were 1.3 or lower. This means that current financial and institutional models for providing water supply and wastewater management have for the most part broken down. Historically, all water supply and wastewater systems were built for either increasing or stationary populations, in both urban and rural areas. There is very little precedent or knowledge as to how to downsize water and wastewater systems to face the new realities of declining population, especially in larger urban centres.

In a large country like India, with a current fertility rate of 2.0 at the national level, fertility rates vary markedly from one province to another from a low of 1.1. in Sikkim to a high 3.0 in Bihar. Thus, water supply and wastewater models of the future need to vary from one state to another, even for the same country. Current indications are that fertility rates are likely to decline further in the future in all Indian provinces, and also in all other parts of the world, aspects that will also have to be considered.

It is thus essential that all new or updated water policies and plans should reflect properly the future conditions of the country/region and not be a simple extension of the past situations. These actions will significantly reduce water requirements for the future for many countries, both developed and developing.

Second, it is now evident that the impacts of climate change on the water sector are going to be more severe than what was anticipated even as late as 2020. Historically, climatic patterns all over the world have fluctuated with time. Accordingly, existing water management practices are primarily based on the assumption of a stable climate as was witnessed in the 20th century. It will be essential for the water profession to consider how new paradigms and practices could be developed which could successfully cope with the changing climatic regimes of the future.

This is also the case with politics. The reason why 40 million people living in the Colorado River Basin have been having a difficult time with water availability is because water is still being managed under 19th-century laws, hydraulic structures were built during the first half of the 20th century, and their management practices were mostly defined during that period. Not surprisingly, the basin's water management is facing serious problems in the 21st century.

Third, scientific and technological developments, management practices and people's attitudes to and perceptions of water-related problems have changed with time and will continue to change in the coming years. These advances and changes are not always considered in national or subnational water management policies and plans. As people have become more aware of the importance of water conservation, and also water has become scarcer and more polluted, water used by individuals, companies and farmers will continue declining. This is already apparent in numerous countries, both developed and developing, and needs to be considered when formulating and implementing policies.

Fourth, the water profession, like most other professions, is conservative by nature. It often prefers the status quo rather than making required radical changes. For instance, even against scientific evidence, the water profession is still using obsolete paradigms like integrated water resources management (IWRM) or integrated river basin management (IRBM). On the one hand, the water profession claims 'one size does not fit all', but on the other, it automatically and implicitly assumes that IWRM or IRBM fits all sizes, large, medium or small, from megacities to small rural villages, in monsoon to temperate countries, from advanced countries to least developed countries, and also irrespective of the political and institutional structures and capacities of the countries.

A concept like IWRM has been around since the mid-1930s in one form or another. It did not work well and thus was mostly jettisoned by the late 1960s. However, following the Dublin Conference, in 1992 the IWRM concept received a new lease of life. It has been heavily promoted by a few Western European countries, even though they have not succeeded in implementing IWRM or IRBM concepts in their own countries over the past three decades.

In fact, in China, a country that has made remarkable progress in water management, especially during the post-2000 period, its very success has often been based on the antithesis of IWRM. Its river chief system, which was very successful in combating water pollution when it was first tried in Taihu Lake, Wuxi city, Jiangsu province, in 2007, is very opposite to the concept of IWRM. This decentralized and fragmented management regime has been effective in controlling water pollution in several water bodies. In essence, individual government leaders are appointed as river chiefs and they become personally responsible and accountable for managing water pollution in specific sections of rivers and lakes, but only within their own jurisdictions. Their performance as river chiefs, in terms of improving water quality only in the section they are responsible for, is directly linked to their chances of future promotion prospects.

Following the success of the river chief system in the cleaning of Taihu Lake and other similar pilot exercises, the Chinese government rolled out the river chief system all over China from late 2016. Currently, some 300,000 river chiefs have been appointed in a four-tiered system from provincial to township levels. In addition, there are also some 900,000 river chiefs at village levels.

As the world changes and knowledge advances, water management practices and processes must change as well. Certain water management paradigms that were first developed for possible use during the period 1935–60, like IWRM and IRBM, cannot be considered for universal use anymore. If they may work in certain locations, for specific conditions, they could be used. However, as we enter the second quarter of the 21st century, the validity of many existing water management paradigms of the last 50 years need to be seriously questioned. We have to reimagine water management for the future.

Changing societal perceptions of water

In September 2015, all 193 member states of the United Nations (UN) General Assembly unanimously approved 'Transforming Our World: The 2030 Agenda for Sustainable Development'. The water components of the Sustainable Development Goals (SDGs) are covered in SDG 6. One of the targets of SDG 6 is the provision of clean water and adequate sanitation for everyone in the world by 2030. This target of universal access to water has been consistently missed since 1990, when the International Drinking Water Supply and Sanitation Decade, promulgated by the UN, ended. The Decade was expected to help to reach the target of universal access to clean water and sanitation for all by 1990.

The ambitious Decade failed to reach its objective, even though millions of households all over the developing world received access to water during this period. Unfortunately, neither the UN agencies nor the national and international institutions gave much attention to the quality of water supplied. The focus was exclusively on supplying water, irrespective of its quality.

Following the Decade, the Millennium Development Goals (MDGs) were approved by the UN General Assembly in 2000. Its targets were more modest compared with those of the Decade. In the area of water, the target was to halve the proportion of people who did not have access to 'improved' sources of water and sanitation between 1990 and 2015.

Unfortunately, there was no clear and objective definition of 'improved' sources of water. National governments and all national and international institutions assumed that as long as households had access to water, irrespective of its quality, it came from 'improved' sources.

The problem was further obfuscated by the various UN agencies and major international organizations like the World Bank and all the regional development banks by interchangeably using 'improved' sources with 'clean' or 'safe' water in their publications. It gave the erroneous impression that 'improved' sources of water were both 'clean' and 'safe'.

Because of this definitional ambiguity and the poor quality of national data, the UN announced that the MDG target for water was successfully met nearly two years before the target date of 2015. Unfortunately, the target was missed by a wide margin if access to clean water was the objective. In fact, all over the developing world, households are unable to drink water directly from the tap because of its poor quality.

Accordingly, households have been forced to transform themselves into mini-utilities. First, to transform intermittent supply to 24-hour access to water, each household built an underground tank where they stored the water they received mostly for two to four hours each day. They had to instal an overhead tank and then joined the two tanks with

a pumping system. This system allowed them to have 24-hour access to water, even though the supply itself was intermittent.

Since people do not trust the quality of water received, each household had a point-of-use treatment system. In the 1960s, households used to boil the water before drinking. As the quality of water was perceived to deteriorate even further over time, and as households became more informed and richer, they started using filtration systems to purify the water. As water quality further deteriorated, by the late 1980s many households started to use reverse osmosis (RO) to purify the water. At present, in a major country like India, most households in urban and rural areas use RO to purify water before drinking.

It is the poor and underprivileged who cannot afford to instal underground and overhead tanks and a pumping system, as well as point-of-use treatment systems, who continue drinking poor quality water, if this is available.

While the water supply situation in developing countries still leaves much to be desired, situations in developed countries have deteriorated for very different reasons. Households generally have started losing trust in the quality of water they receive from their utilities. Water utilities sometimes have failed to supply clean water, especially in some very well-publicized cases like Flint, USA, or Walkerton, Canada, where numerous people died due to poor quality water. Accordingly, a large and increasing number of households have decided to instal sophisticated point-of-use treatment systems to clean the water they receive and/or use bottled water for drinking.

Trust in water quality became an even more important issue following the emergence of COVID-19 all over the world. The importance of reliable availability of good-quality water for frequent handwashing, drinking and personal hygiene further focused people's attention on the essentiality of having good quality water (Tortajada & Biswas, 2020).

It will be a daunting task globally for the utilities to gain the trust of the people that the water they are receiving is indeed safe to drink and to maintain good personal hygiene.

Another important global issue is that provision of water of good quality has been historically considered to be an engineering issue. Thus, water utilities all over the world are managed and operated almost exclusively by engineers. Combating the trust issue is not a technical problem: it is in the realm of behavioural economics and psychology. Yet, the total number of utilities that have such professionals can be counted by the fingers of one's hands and still may have a few left over! The water profession, historically, has stayed in water-tight compartments and preached interdisciplinary approaches. Major emerging problems for all utilities will be how to recruit and retain behavioural economists and psychologists who can convince consumers that the quality of water they are receiving is safe (assuming indeed it is safe), and also how to change the current behaviour of their consumers, like how to reduce the per capita water use in most cities, sometimes very significantly.

Trust and bottled water

The issue of declining trust in water supplied by water utilities can be illustrated by the explosive consumption of bottled water in recent years, in both developed and developing countries. For example, in many Western countries where nearly in all parts people have access to clean and safe water, it is estimated that 60% of Italians and South Koreans, 38% of Americans and 31% of Canadians use bottled water as their primary source of

drinking water (Bouhlel et al., 2023). Also, in terms of highest per capita bottled water consumption, the two countries that consume the most per year are two developed countries with excellent water supply systems: Singapore and Australia. An average Singaporean consumed, in 2021, 1129 litres of bottled water, costing US$1348. Similarly, an average Australian consumed, in 2021, 504 litres, costing US$386. Yet, the water supplied by the water utilities of Australia and Singapore is of excellent quality and totally safe to drink.

Globally, the top four countries that spend the most on bottled water are the United States (US$63.84 billion), China (US$49.17 billion), Indonesia (US$21.94 billion) and Canada (US$12.41 billion).

There is a general perception all over the world that bottled water is safe to drink and tastier than tap water. Yet, a blind tasting of tap and bottled water in Tokyo indicated that this is not the case. Our hypothesis is the primary reason for this perception is that bottled water companies spend hundreds of million dollars each year on marketing and advertising. This has contributed to the development of an overall societal perception that bottled water is safer, tastier and healthier to drink, even when this is not the case.

Be that as it may, the global market for bottled water is now estimated at US$270 billion. Currently, nearly 60% of all bottled water sold is in developing countries where the water supply is mostly unreliable and the quality of water supplied leaves much to be desired. It is estimated that the global bottled water market would reach around a US0.5 trillion by 2030, with explosive growth in many developing countries, especially in India and Egypt (Bouhlel et al., 2023).

The current trends indicate that trust in water supply will continue to decline further in the coming years unless water utilities take active measures to reverse this trend. There are no signs that it is likely to happen over the near-to-medium term.

Carbon neutrality

Nearly all countries have pledged to be carbon neutral between 2045 and 2070. Achieving this carbon neutrality means that all water supply and wastewater management systems as well as hydraulic structures like dams and irrigation canals, should be carbon neutral by the target dates, for both their capital expenditures and operational and maintenance activities.

While some water utilities in developed countries have already begun to consider how they could become carbon neutral within the next two decades, challenges are going to be enormous. While it should be possible to become carbon neutral in their operational and maintenance activities within the next two decades, this is not likely to be possible for their capital expenditure activities in terms of building new infrastructure and making existing infrastructure carbon neutral. This will require the development of new and cost-effective technologies for large-scale carbon capture and sequestration. This is unlikely to happen before 2035 at the earliest.

In order to be carbon neutral even in operational and maintenance activities, water utilities have to reimagine their current practices and financial models. They will have to actively encourage their domestic and industrial customers to reduce their water consumption, in most cases significantly. Reduced water consumption will mean wastewater generated will be less as well. This means utilities will have to reimagine their financial

model since less consumption of water and reduce wastewater generation will reduce their overall incomes. The utilities as well as traditional water departments will have to radically adjust their modus operandi so that they can still be economically viable and concurrently become carbon neutral.

All these and other associated issues not discussed in this Editorial but outlined elsewhere (Biswas & Tortajada, 2023) indicate that the world does not have a problem because of physical lack of this resource, either near-term or long-term, but it does have a serious problem due to poor management of water everywhere for a prolonged period. We have the knowledge, technology and investment capacities to manage water significantly more efficiently.

If we can reimagine how water should be managed in the future, the world should not face a water crisis, not only in 2050 but also by 2100 when the global population and economic activities will be significantly higher than what they are today. Unlike the numerous current Cassandras, we are cautiously optimistic about the world's water future.

Papers in this issue

The current issue contains several thought-provoking papers. Ahmad et al. (2022) discuss resettlement delays and other problems with the Dasu Hydropower Project, Pakistan, and their potential solutions. Factors affecting groundwater-based performance of rural water supply schemes in India are analysed by Kumar et al. (2022). How multi-stakeholder collaboration can contribute to a water-secure future is assessed by Decker (2022). Complexity of water reallocation decision-making in the Heihe River Basin, China, is outlined by Wei et al. (2022). Toan and Anh (2022) investigate factors attracting the participation of the private sector in rural water supply schemes in Vietnam. Pisaniello et al. (2022) review how dam safety regulations can be adequately funded based on Australian and other international experiences. Finally, Stephens et al. (2022) review international capacity-building to achieve SDG 6 based on insights gleaned from longitudinal analysis of five water operator partnerships.

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