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EDITORIAL

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Global crisis in water management: Can a second UN Water Conference help?

More than 60 years ago, President John F. Kennedy said: "Anyone who can solve the problems of water will be worthy of two Nobel Prizes—one for peace and one for science." During the past six decades, global water situations, both in terms of quantity and quality, have become progressively worse and increasingly more and more complex.

It has already been abundantly clear during the past six decades, unlike Kennedy's view, the world's water problems are primarily political, and not scientific or technical, and, thus, can be best approached and solved through political processes in each country, state, or municipality. Scientific or technical advances may solve some specific water-related problems, but the main solutions remain, and will continue to remain, in the political realm. Unfortunately, however, even though the main solutions are political, very, very few political leaders, in any country in the world, have shown interest in water over prolonged periods of time. They are interested in water only when there is a serious flood or drought. Once the flood or the drought is over, their interest in water invariably disappears (Biswas, 2019).

President Kennedy was no exception as a political leader. His interest in water did not last very long, in fact, less than 1 year. Yet, no water problem of the world can be solved over the long-term unless seniormost politicians continue to remain interested in water. The only exception during the past 60 years has been Singapore. Its Prime Minister for the 1959–1990 period, Lee Kuan Yew, was convinced that water is a strategic resource, and Singapore's very survival and future economic development depended on ensuring water security. Accordingly, he had three people in his office who analyzed all national policies through the lens of water, both in terms of quantity and quality. He told us, as far as he was concerned, all policies Singapore, adopted during his tenure, had to bend in the knee for water (Tortajada et al., 2013).

In 1959, when Lee Kuan Yew became the Prime Minister, Singapore's water management practices were similar to any other Third World city, from Delhi to Dakar. By the time Lee stepped down as the Prime Minister in 1990, Singapore's water management had become the envy of the world. Under Lee's leadership, Singapore formulated a long-term water security plan for 2060. It has been rigorously and regularly updated every 5 years, thereafter reviewed by the entire cabinet and its implementation has always been carefully monitored. Fortunately, the interest of Singapore's top policymakers in water has steadfastly remained high during the post-Lee period.

Political leaders of any other country, developed or developing, could follow Singapore's footsteps regarding water's high political priority. As global water situations have mostly deteriorated, discussions of the resulting crises have become a growth industry. Putting "water crisis" in Google, in early March 2023, resulted in the identification of 805 million items. The number is likely to continue increasing exponentially in the coming years, especially if water situations continue to decline in most countries of the world.

1 | IS THERE A GLOBAL WATER CRISIS?

From our analysis, unlike the current mainstream thought, the world is not facing a water crisis because of physical lack of this resource. However, it is facing a crisis because of decades of poor water management practices. The two views are very different.

Consider the following incontrovertible facts. Water, unlike fossil fuels, is a renewable resource. This means water can be used, used water can be collected and properly treated, especially for domestic and industrial uses, and treated wastewater can be used again. When properly managed, this virtuous cycle can continue indefinitely. Accordingly, if the world's available water resources are properly managed, there is not only enough water for now but also for the year 2100, when the world's population is likely to reach 10.9 billion, the level of urbanization will be much higher than at present as well as the level of economic and social development. However, this will require good and efficient water management practices for all types of water uses, domestic, industrial, and agricultural.

Consider the city of Windhoek, the arid capital of Namibia. It has been using this circular urban water use process since 1968. The Goreangab wastewater treatment plant has been properly treating domestic sewage generated

by Windhoek, and then recycling it directly to its potable water system. In over 50 years of operation, the city has not had health problems. Windhoek, in the middle of a desert, has successfully reused its treated wastewater in its municipal water supply system. If a developing country city like Windhoek can effectively practice circularity of urban water use for over 50 years, there is no reason why urban centers of both developed and developing world cannot follow its footsteps. The lack of progress in other urban centers of the world has certainly not been because of lack of technology, expertise, or funding, but primarily because of lack of political leadership and sustained political will.

Furthermore, water professionals have made several fundamental assumptions that, unfortunately, have no scientific underpinning. However, these assumptions have been repeated ad nauseum for several decades, and, consequently, no one questions their validity anymore.

A study by World Resources Institute (2013) concluded Singapore had the highest water stress ranking (5.0) in the world, along with some other very arid countries of the Middle East, including Qatar and the United Arab Emirates. The fundamental question one needs to ask is has any Singaporean felt any form of water stress during the past 50 years, or feels likely to face serious stress for the next half-century? The answer will unquestionably be that the city–state has been managing its water so well that none of its residents has faced any form of water stress during the past half century, and nor do they expect any for at least the next 50 years. This is because assumptions behind WRI analyses are fundamentally flawed, even though its results have been frequently quoted.

Similarly, some have claimed that water is one of the natural resources which has already flipped below the tipping point of sustainability. This is incorrect, even though numerous examples of poor water management, from all around the world, have existed for decades, and exist now. These poor practices have given rise to serious cases of water stress.

Let us review the Colorado River Basin in the United States that is now facing unprecedented water shortage problems due to a multi-year megadrought. The seven Colorado River Basin states, and some 40 million people, are now facing serious shortages of water and hydropower.

The crisis in the Colorado River Basin is man-made. The fact is the Basin has been suffering from 19th-century water laws, and first half of the 20th-century hydraulic infrastructure, water allocations between states and water management practices. Naturally, these old combinations of laws, hydraulic structures and their management practices, have been simply unable to cope with water demands of the 21st century. The magnitudes and extent of the water problems of the Basin have been known for decades, though they have been exacerbated in recent years due to climate change impacts. However, politicians have regularly dithered to take appropriate actions primarily because politically the needed policies have been unpalatable. Even now, for the second time in 6 months, the largest water user, California, has declined to accept policy options agreed to by the six other states. Good solutions have always existed, and they still exist, but they require fundamental changes as to how water is managed for different purposes, and if the current uses are justified. The Basin has needed an implementable plan for the future for decades which should have considered long-term water availability, given all the uncertainties of climate change. This has to be the new policy. Business-as-usual policies should have been long jettisoned.

2 | REDUCING WATER USE

Let us discuss how total water use can be significantly reduced.

Agriculture is the biggest user of water on a global basis. Unfortunately, there are no reasonably reliable estimates of how much water is used by the agricultural sector globally, or even in individual major countries like India or Nigeria, either historically, or at present. While some estimates are available for individual countries, no one really knows their accuracy. Thus, when all these mostly unreliable national data are aggregated into one global statistic, their accuracy is at best dubious. The same goes for data for industrial and domestic water uses, both by countries and globally.

Globally, on a percentage basis, share of water used for the agricultural sector has been steadily declining in recent years. However, in terms of absolute quantities of water used, agricultural water use is probably still increasing.

It is at present generally assumed that about 70% of water used globally is for agriculture. In reality, this could be anywhere between 62% and 78%. However, in recent years, a few major countries have made a concerted attempt to reduce the quantities of water used for the agricultural sector. Simultaneously, they have taken steps to ensure that the total agricultural production remains the same, or even higher. This is to safeguard national food security.

China is a good example. Between 1990 and 2012, water used per hectare of irrigated land declined by 20% (Doczi et al., 2014). Even then, with improved water and agricultural management practices, crop yields per hectare, during this period, increased significantly. China has continued to reduce its water needs per hectare of agricultural land further since 2013. It has also simultaneously ensured its total agricultural production continues to increase. This trend is likely to continue over the next two decades.

The Chinese example of reducing agricultural water use significantly, but still increasing total agricultural production, has major implications for all developing countries. Agricultural water uses in many developing countries often exceeds 80% of total water use. Accordingly, significant potential exists to reduce current agricultural water use by 30%–45% within the next two decades through appropriate policy interventions, increased mechanization, more use of

cost-effective technologies, and improved agricultural management practices. Properly done, this will reduce not only agricultural water use but also increase agricultural production, and thus improve individual farm income and the quality of life of the farmers.

There is no question that there is considerable scope for reducing agricultural water use, provided policymakers, in both developed and developing countries, are willing to take some difficult political decisions. Unfortunately, there are not many signs that this is likely to happen anytime soon.

Industrial water use—Globally, industrial sector is the next highest user of water, after agriculture. In this sector as well, there is significant potential to reduce total water use.

Around 2005, several major multinational companies (MNCs) realized that if they would like to survive and thrive, they had to reduce their water consumption patterns very significantly. MNCs have manufacturing plants all over the world, including numerous ones in arid regions. With increases in population, urbanization, and industrialization, competition for obtaining reliable sources of water, especially in arid and semi-arid regions, was becoming an existential threat. Thus, chief executive officers of several MNCs were forced to consider, over the past 15 years, how they could radically decrease the water requirements of their factories. This included significantly improving water use efficiencies everywhere, treating and reusing wastewater, and instilling water conservation ethos among all their staff members.

The impacts of these decisions from the very top management have been absolutely remarkable for many MNCs. Only two examples will be discussed herein. First is Unilever, one of the world's largest MNCs. In 2010, it initiated its Unilever Sustainable Living Plan. This 10-year ambitious plan had the aggressive goals to double its sales, but cut its environmental footprints by half, and help one billion people to improve their health and well-being. During this 10-year period, Unilever reduced water use per tonne of production by 49% and ensured all electricity needed for manufacturing came from renewable sources. It also managed to reduce its carbon emissions from its manufacturing processes by 65% (Unilever, 2021).

Nestlé is the second MNC that has been actively working on reducing its water footprints in all its factories throughout the world. In 2010, it drew up a plan to improve its water use management practices significantly by 2020. During this 10-year period, it reduced its water use per tonne of manufactured products by 28.7%. It now monitors, in all its factories, their total water use, and how much wastewater is produced and treated, including their quality and extent of reuse. In 2021, Nestlé's total water use was 98 million m^3. This was a 15% decrease over 2020.

Probably, the most innovative work, in terms of water conservation, has been in its milk products factories. It is one of the world's largest manufacturers of milk products, including powdered, condensed, and baby milk. Nestlé has already converted some of its milk product factories into "zero water" factories, that is, in these factories, no water is currently being withdrawn from the environment.

Milk contains 87% of water. The steam resulting from the evaporative processes is collected, condensed, and then treated. This "new" water is then used for running of the factories. Nestlé's first "zero water" milk factory was in Lagos de Moreno, in an arid part of Mexico, with high water stress. The new process has been so successful that the factory now even sells surplus water to another nearby factory.

Nestlé has already converted its milk factories in Mossel Bay, South Africa; Modesto, California; and Qingdao, China, to "zero water" factories. It is in the process of transforming many of its other milk factories into "zero water" factories.

Unilever and Nestlé are only two examples of how many industries are reducing their water footprints because of both existential and reputational reasons. Any listed company now has to seriously consider its environmental, social, and governance (ESG) performance, and also comply with regulatory requirements that are increasingly forcing them to report regularly their ESG performance. This means that they have to regularly monitor and make public their water management scorecards.

Domestic Water Use—It now accounts for 8%–10% of global water consumption. Even for this most important water use, there is much fundamental information that is not known.

Consider this fundamental question: how much water does a human being needs, per day, to lead a healthy and productive life? Unfortunately, the answer to this important question is mostly unknown. The only ever known study on this issue was done in Singapore, over a 10-year period of 1960–1970 (Biswas, 1981). This study attempted to correlate domestic water use in relation to incidences of water-borne diseases reported in Singapore hospitals. The results indicated that as domestic water use went up, disease incidences went down. However, there did not appear to be any improvement beyond 75 L of daily per capita of consumption of good quality water. Accordingly, this quantity of water could be considered to be necessary to lead a healthy and productive life.

This level could be correct. For example, water consumption in several West European cities is now already between 75 and 84 L per capita per day. In Denmark, water consumption per capita per day is 104 L. It has steadily declined during the past two decades. It is highly likely to go down even further in the coming years. In Zaragoza, Spain, per capita daily water consumption has declined from 135.5 L, in 2000, to 94.4 L, in 2018 (Figure 1). It is still continuing to decline.

These facts indicate that per capita water use needed to lead a healthy and productive life is likely to be around 75 L, as was found in Singapore over 50 years ago. Unfortunately, no similar studies have been conducted anywhere in the world, even though many countries have established arbitrary levels. If the results of the 50-year-old study are still valid, and global water consumption per

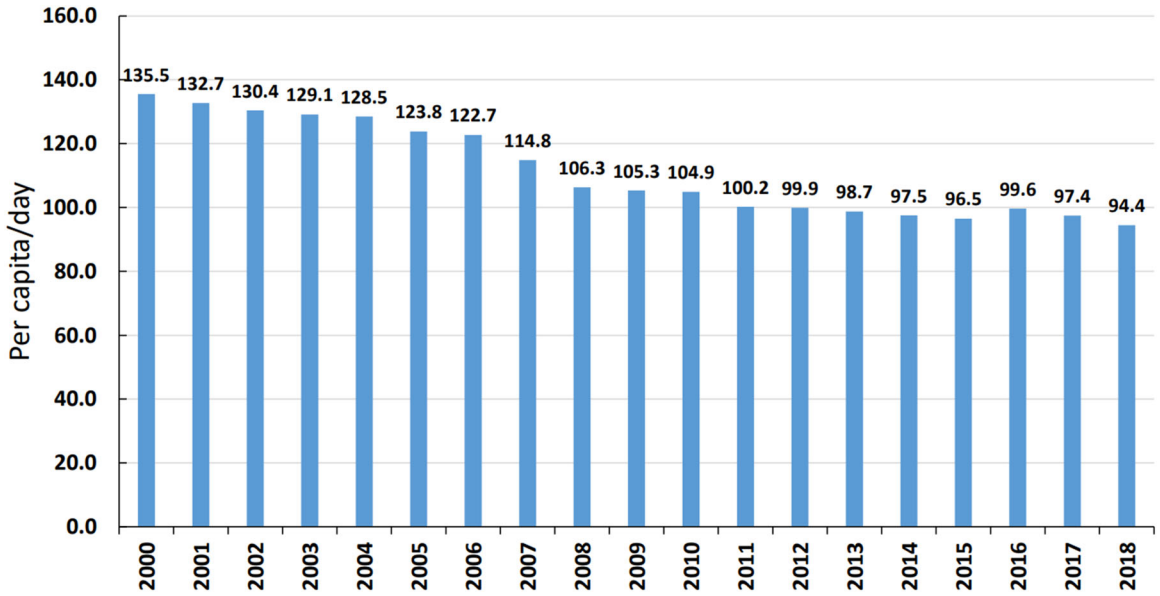

FIGURE 1 Water consumption of drinking water per capita in Zaragoza, Spain, 2000–2018. *Source*: Climate Adapt, no date. https://climate-adapt.eea.europa.eu/en/metadata/case-studies/zaragoza-combining-awareness-raising-and-financial-measures-to-enhance-water-efficiency/11210288.png/view.

capita trends down to this level, within the next two decades, total domestic water consumption globally would be reduced very significantly.

In contrast, consider recent domestic water use figures from Qatar, one of the world's most water-stressed countries. An average Qatari citizen uses around 595 L per capita per day. In the United States, per capita daily consumption is 310 L. Both these figures indicate that the Qatari and the Americans are using significantly higher quantities of water than necessary to lead a healthy and productive life. Overuse of water for domestic purposes is now endemic in most countries, especially for those households who receive piped supply. Accordingly, there is very good potential for significantly reducing domestic water consumption in most countries of the world, without any detrimental impacts on human health and productivity.

This means total global water consumption, given adoption and implementation of proper policy frameworks, can be reduced by 40%–50% over the next 15–20 years, with current knowledge and technology. Future advances in knowledge and technology will undoubtedly contribute to further improvements in agricultural and industrial water uses.

3 | SECOND UN WATER CONFERENCE AND CAN IT HELP TO SOLVE WORLD'S WATER PROBLEMS?

The first UN Water Conference was held in 1977, in Mar del Plata, Argentina. This Conference, held over 2 weeks, was a landmark in terms of improving global water situations notably. Its remarkable Secretary General, Yahia Abdel Mageed, who was earlier the Minister of Irrigation and Hydropower Development of Sudan, made a determined attempt to assess the then global water problems, as well as likely future ones, and then search for possible solutions on a holistic basis.

Mageed ensured there were proper consultations with important stakeholders in every region of the world. Equally, he realized that such large consultations of stakeholders often end up with the acceptance of views that are the lowest common denominators to achieve consensus. He thus commissioned special but succinct reports by the world's leading then water experts. He had these reports peer reviewed and modified by the authors. These reports were available to all the Conference participants.

Two main reports are worth reading even after over 45 years which is a tribute to their quality. The first was entitled *Resources and Needs: Assessment of the World Water Situation* (UN Water Conference Secretariat, 1978a) and the second was on *Policy Options* (UN Water Conference Secretariat, 1978b). The first one was prepared by Prof Gilbert White, probably the global doyen of water in the 20th century, and the second one was drafted by Blair T. Bower, from Resources of the Future, Washington, D.C.

The world has changed remarkably since 1977 when the first UN Water Conference was held. World population then was 4.2 billion; it is now 8 billion. Global GDP per capita has increased from US$1747 in 1977 to $12,663 in 2021. Other social and economic indicators have changed, all over the world, since then.

Furthermore, there have been other significant changes during this intervening period. For example, in 1977, climate change considerations were not even on the radar of either governments or water professionals. Now they are a major concern. Human knowledge doubled every 25 years after the Second World War. This doubling time was

reduced to 13 months by 2013 and is soon likely to double every 12 h. Nearly 90% of data in the world have been generated during the past two years. With extensive use of sensors and robots in the water sector, data generated have been increasing exponentially, especially during the past 2015-world (Biswas & Tortajada, 2023). This means the water profession now can get more granular knowledge from trillions of data points that were not available before. Similarly, computing and storage capacities have made remarkable advances since the Mar del Plata Conference. Around 1977, storage cost per gigabyte of data was over $1 million. Now it is a fraction of 1 cent. These should and could revolutionize water management practices around the world.

Sadly, important advances in water management are not happening, except in a few water management institutions in only a select few countries. And, even when they are occurring, they are not known, in much of the world, except to a few water professionals.

Thus, a second UN Water Conference, which could have reviewed comprehensively water problems of the world, in both developed and developing countries, would have been very desirable. It could have assessed what are current and likely future water problems, and how these could be solved cost-effectively, in a socially- and environmentally acceptable manner, and within a prescribed timeframe. This is urgently needed, and only major international organizations like the United Nations, OECD, or the World Bank, have the prestige, gravitas, and capability to bring all the governments, leading academics, and other important stakeholders together to agree to a global water action plan.

Unfortunately, if one examines the available information comprehensively, even though it is being touted as the second UN Water Conference, it is nothing of the sort. Its objective is very limited since it is to carry out a "Midterm Comprehensive Review of the Implementation of the International Decade of Action, 'Water for Sustainable Development', 2018–2028." Regrettably, a true second World Water Conference is yet to be conceived, let alone organized.

In addition, unlike the First Water Conference, it is not being managed by an independent and dedicated Assistant Secretary General of the United Nations: the Second one is being directed and co-hosted by the Governments of the Netherlands and Tajikistan.

The Second Conference is unlikely to come out with any new innovative ideas, or will challenge the "official" thinking of the last 40 years which has consistently failed to meet the stipulated targets. In addition, it would not question why the SDG targets for developed countries are not being considered. Water quality continues to be a serious problem for most developed countries. Even in the United States, at present, more than two million people do not have access to indoor plumbing or safe drinkable water. In Australia, Canada, and the United States, indigenous populations still do not have access to clean water or proper wastewater disposal. Yet, the UN continues to think, erroneously, that water problems exist only in developing countries. Developed countries have already solved them, which is incorrect.

Furthermore, there has been a disturbing trend in all developed countries because an increasing number of populations are losing trust in the quality of water they receive from their water utilities. These numbers have further increased after Covid-19 when quality of water needed for regular handwashing became an important consideration. More and more people in the developed world are now using point-of-use treatment systems over which they have control, and/or using bottled water. In Germany and Japan, very few households drink water from the tap, even though tap water is safe to drink. This is a behavioral issue that neither the water profession nor governments are considering. Loss of faith in tap water has been further accelerated by well-publicized poor management practices in cities like Walkerton, Canada, and Flint, Michigan.

For developing countries, situations are significantly worse. It is hard to find a single household in any developing country that trusts the quality of water received from their utilities. Whatever water they receive is treated by each household by point-of-use treatment systems. These issues have been completely absent from discussions in various global water fora during the past four decades.

With respect to sanitation, the situation is even worse. Millions of toilets have been built in the developing world in recent years. This, of course, is a step in the right direction but this is not enough. No serious thought has been given to how the wastes from the septic tanks can be managed in an environmentally-sound way so that there is no water contamination from them, and thus no adverse health impacts.

Even if only access to water is considered, without reference to quality or trust in current sources of supply available, only about 16 developing countries are likely to reach the SDG targets by current trends, by 2030. The world now needs to consider another set of new targets for achieving universal access to clean water and proper sanitation by 2050. Chances of meeting SDG targets by majority of the countries are now near zero.

There are many reasons why several developing countries are making limited progress in providing clean water and proper wastewater treatment to their citizens. A major constraint in many countries, ranging from India to Mexico, is that their heads of water utilities have, on average, a tenure of about 18 months. The heads, when appointed, for the most part, have limited background on water or running utilities. Equally, they are aware that they have only very limited time to turn around the poorly performing utilities. By the time they understand the problems with the utilities and start making plans, their tenures are generally over.

These governments need to make institutional changes that would enable the utility heads to be head-hunted. The carefully selected heads should be appointed for an initial 3-year period, which could then be renewed for a further 3

years, provided the heads meet certain clearly stipulated and agreed upon key performance indicators. This one change would probably solve 70% of the problems of these countries, with existing budgets. However, politically this is unlikely to be an attractive proposition.

It will be rather surprising if these types of real macro policy issues would be raised, let alone be seriously discussed during the forthcoming Conference.

The Second UN Water Conference is likely to exhort countries to make determined attempts to meet the SDG targets, and appeal for more funds to be made available to meet the SDG targets. The fact is there is no dearth of funds if the projects formulated are "bankable." As the Phnom Penh Water Supply Authority has clearly shown over the past 25 years, when the water utilities have good governance models, including a credible and sustainable financial model, funders will fight with each other to provide the necessary funds (Biswas et al., 2021). Those utilities that do not have a credible financial model will continue to struggle in attracting finance for capital investments. No matter how much exhortations are made, fund available will not be enough to meet the targets.

It should be realized that more of the same is not progress. It is rather a sign of mediocrity, especially when business-as-usual policies have failed during the past four decades. Continuation of the same is realistically a triumph of hope over experience. As William Shakespeare wrote in Julius Caesar; "The fault, dear Brutus, is not in our stars, But in ourselves, that we are underlings."

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