

Water, Sanitation and Health in Developing Countries: How Far from Sustainable Development?

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Abstract—The availability of water in adequate quantity and quality is imperative for sustainable development. Worldwide, significant imbalance exists with regards to sustainable development particularly from a water and sanitation perspective. Water is a critical component of public health, and failure to supply safe water will place a heavy burden on the entire population. Although the 21st century has witnessed wealth and advanced development, it has not been realized everywhere. Billions of people are still striving to access the most basic human needs which are food, shelter, safe drinking water and adequate sanitation. The global picture conceals various inequalities particularly with regards to sanitation coverage in rural and urban areas. Currently, water scarcity and in particular water governance is the main challenge which will cause a threat to sustainable development goals. Within the context of water, sanitation and health, sustainable development is a confusing concept primarily when examined from the viewpoint of policy options for developing countries. This perspective paper aims to summarize and critically evaluate evidence of published studies in relation to water, sanitation and health and to identify relevant solutions to reduce public health impacts. Evidently, improving water and sanitation services will result in significant and lasting gains in health and economic development.

Keywords—developing countries, health, sanitation, sustainability, water

I. INTRODUCTION

WATER is a vital limited resource for human existence and the availability of adequate and safe water ties strongly with the sustainable development concept. Economic development and population growth have resulted in an immense increase in the consumption of natural resources and all kinds of energy. However, this growth was accompanied by environmental pollution, adverse impacts on the global climate, resources depletion and ecosystems degradation. Unquestionably, environmental degradation impacts people's health, poverty level and economic development. Moreover, water is a critical component of public health, and failure to supply safe water will place a heavy burden on the entire population. Although the 21st century witnessed richness, wealth, and advanced development, billions of people are still striving to access the most basic human needs which are food, shelter, safe drinking water and sanitary systems. Reducing the impact of human activities on the environment is essential to ensure a healthier and more sustainable future. Water is used

for various purposes including municipal and industrial supply, agricultural irrigation, hydroelectric power generation, waste assimilation, and recreation. Evidently, it is a common resource that intersects all sectors of development. As such, the sustainability of water resources can indicate sustainable development [11]. Currently, water scarcity and in particular water governance is the main challenge which will cause a threat to sustainable development goals. Lack of laws, and regulations, lack of institutional framework, conflicting interests concerning riparian rights and access to water and diversion of public resources for private returns are the main causes for water governance conflicts [23].

II. WATER, SANITATION AND HEALTH: SITUATION ANALYSIS

The availability of water in adequate quantity and quality is a prerequisite for sustainable development [6]. On a global scale, since the beginning of the 20th century, water consumption has increased about seven folds as a result of an increase in per capita use as well as population growth. Water is an essential part of any ecosystem and reducing the quantity or adversely affecting the quality will have devastating effects. For example, floods are more frequent in areas experiencing deforestation and soil erosion. Even where there is enough water to meet current needs, most surface and groundwater resources are becoming progressively more polluted as a result of domestic and industrial wastewater discharge, agricultural activities and land use changes. Widespread, concentrated and continuous inputs of pollutants from point and non-point sources may overcome the inherent ability of rivers to assimilate pollution. Degradation caused by poor land use practice, land clearing, inappropriate cropping techniques, or overgrazing alters hydrological factors and increases the vulnerability of water resources [1], [5]. Ecological cycles are also threatened by over abstraction of surface waters which impacts the in-stream environment, exacerbates saltwater intrusion, affects the productivity of land in estuarine areas, and reduces the assimilation capacity of rivers. Moreover, poor sanitation and uncontrolled waste discharges from urban, agricultural, mining and industrial developments affect water quality and have costs for downstream users through imperilling public health and degrading aquatic ecosystems [4], [18].

Waterborne diseases have a great burden on both public health and economy. Globally, 4 billion cases of diarrhoea occur annually of which around 2 million people die. In developing countries, nearly 80% of all diseases are linked to

water and sanitation [27]. Children bear the greatest health burden related to poor water and sanitation. Diarrhoea is a major cause of death among children worldwide causing death of one in five children and 15% of all deaths in under age 5 children [19], [29]. A summary of the situation analysis with regards to water, sanitation and health is presented in Table I. Seemingly, great disparities among developed and developing countries exist that are being concealed by the global picture. In addition, progress is inequitable particularly between urban and rural communities as well as between rich and poor households.

TABLE I
 A SUMMARY OF THE SITUATION ANALYSIS WITH REGARDS TO WATER, SANITATION AND HEALTH [12], [22], [24], [27], [28]

Water
<ul style="list-style-type: none"> • 47 percent of the world's population will be living in areas of high water stress by 2030. • Two-thirds of the world's population, about 5.5 billion people, will live in areas facing moderate to severe water stress by 2025 • 884 million people still rely on drinking water from unimproved sources such as ponds, streams, irrigation canals and unprotected dug wells. • One in eight people worldwide lack safe water. • Less than 20% of the world's drainage basins exhibit nearly pristine water quality. • 84% of the world population without an improved drinking water source lives in rural areas. • 70% of untreated industrial wastes in developing countries are disposed into water bodies contaminating existing water supplies. • 2 million tons of human waste are disposed of in water courses every day. • 50 percent of the world's wetlands have disappeared in the past century. • Many of the most important groundwater aquifers are being depleted.
Sanitation
<ul style="list-style-type: none"> • 2.6 billion people in the world do not have access to adequate sanitation, nearly two fifths of the world's population. • 18 percent of the world's population or 1.2 billion people defecate in the open. • Sanitation coverage in developing countries (49%) is only half that of the developed world (98%). • Two in five people do not have the security and dignity of a hygienic latrine or toilet. • 64% of the people who gained access to improved sanitation during the period 1990-2008 live in urban areas.

- More than 80% of sewage in developing countries is discharged untreated, polluting rivers, lakes and coastal areas.

Health

- 1.8 million people die every year from diarrhoeal diseases; 90% are children under age 5, predominantly in developing countries.
- Nearly half the people in the developing world are suffering from one or more of the main diseases associated with dirty water and inadequate sanitation such as diarrhoea, guinea worm, trachoma and schistosomiasis.
- Diarrhoea kills more young children than AIDS, malaria, and measles combined.
- Naturally occurring arsenic pollution in groundwater now affects about 140 million people in 70 countries.
- About 10% of the total burden of disease worldwide is attributable to unsafe water, sanitation, and hygiene.
- Approximately 443 million school days each year are missed due to water-related illnesses.

Furthermore, there is inadequate progress in sanitation services and wastewater treatment. Access to sanitation services is disproportionate in the developing countries whereby services in some countries do not adequately reach the poor and the rural areas. Estimates of the World Health Organization (WHO) and the Water Supply and Sanitation Collaborative Council indicate that 25 percent of the developing country urban dwellers lack access to sanitation services with a much higher percentage for the rural populations of developing countries reaching up to 82 percent [3]. Thus, in order to achieve the Millennium Development Goals (MDGs) there is a need to approximately double the sanitation investments to about \$7 billion a year in infrastructure solely [20]. According to WHO, current water and sanitation conditions in developing countries are costing about \$84 billion per year [27].

III. CHALLENGES FOR DEVELOPING COUNTRIES

The fact that water is a necessity for life, an economic resource and an important component in ecological processes presents a challenge to sustainable water resources management [15]. It is essential to understand that acceptable or improved water supplies refer to sources that are protected from contamination, but are not necessarily free of pathogens or safe for drinking. Likewise for improved sanitation, it is important to realize that these facilities hygienically separate human excreta from human contact but are not necessarily connected to a sewerage system or a wastewater treatment plant [28]. There is a need for more knowledge and reliable data about environmental conditions, trends and impacts. Moreover, there is a need for projects evaluation and follow up to ensure integration, equity and sustainability. It is crucial not only to provide improved water and basic sanitation, but

also to make sure that these services provide safe drinking water and adequate quantities for various domestic uses, ensure equity, and protect public health.

One of the greatest challenges faced by decision makers is acquiring information that will guide the use and protection of water resources. Equally important is the reliability and thoroughness of the data. The gap in the quality, accessibility, consistency, credibility and reliance of data between the developed and the developing countries has been augmented considerably impeding countries ability to make informed decisions concerning environment and development [21]. Such information is essential to provide a basis on which regional and national level policy decisions can be based. The insufficiency of data about pollution sources, natural conditions, and water-quality conditions, as well as the lack of information related to cultural, social and economic factors often hinder the development of effective management strategies particularly in developing countries. Likewise, the lack of coordination between the different institutions with direct decision-making authority for water resources management impedes sustainable management.

Water mismanagement is a problem facing many developing countries as a result of ill-advised investment, weak institutional capacity and lack of policies and regulations. There is a need for long-term datasets and indicators that may be used as management tools. In countries with large seasonal variations and where agriculture heavily depends on water particularly during dry season, identifying the pertinent indicators is essential in case of investment to increase storage capacity. Other indicators of interest include for example, social justice, distribution and equity of access (rural-urban, rich-poor, residential-industrial-agricultural), distribution of water quality across the different districts in the country and mechanism of access (property rights, water suppliers and vendors). Despite all the efforts and developments, there is still a lack of appropriate institutional mechanisms and administrative frameworks to regulate equity of resources use, lack of effective involvement of the private sector and the general public as well as lack of practical use of implementation tools.

The poor coverage of the sanitation services in developing countries, primarily in rural areas, and the lack of funding to provide centralized conventional services present a major impediment towards achieving the MDGs. Meeting the MDGs for water and sanitation in the next decade will require significant economic resources, sustainable technological solutions and political determination. In many developing countries, issues related to sanitation tend to receive less attention and fewer financial resources than the provision of a water supply. Often, the high cost of wastewater treatment and management is a major impediment towards implementing such projects. Wastewater treatment plants represent one of the major investments due to high capital cost in addition to operation and maintenance cost. Restricted local budgets, lack of local expertise, and lack of funding, result in inadequate operation of wastewater treatment plants in developing countries [14].

Noticeably, providing access to safe drinking water and adequate sanitation is a challenge in many developing countries. This may be attributed to population growth and increased urbanization, thus resulting in increased demand on the existing water supply and distribution systems aggravated by the fact that these systems have cracks and high leakage [10]. Climate change represents an additional burden to the aforementioned challenges as a result of disruptions to hydrological cycles and extreme weather events. Changes in precipitation, runoff and evapotranspiration rate as a consequence of climate change will be added on top of the aforementioned pressures.

IV. RECOMMENDATIONS

Facing the aforementioned challenges requires research, monitoring, and evaluation to:

- Ensure safe drinking water.
- Improve access and efficiency of water use.
- Improve sanitation and wastewater treatment using affordable and feasible technologies.
- Enhance sustainability and equity of services particularly for marginalized and poor communities.

Given the huge differences between developed and developing countries in political structures, national priorities, socio-economic conditions, cultural traits, and financial resources, adoption of developed country's strategies for water and wastewater management is neither appropriate nor viable for developing countries. Considering the limitations of external and domestic financial resources in developing countries, it will be necessary to develop new innovative financial schemes which could include public-private partnership to finance such investments. Recognizing that sustainable water management cannot be achieved by one organization or one segment of society, environmental education as well as public awareness and participation primarily of resource users should be given high priority to achieve sustainability. A high priority should also be given to preventive actions which are less expensive, such as the reduction of waste through cleaner technologies and processes, than to curative actions [9].

In line with available resources, phased expansion of sewerage and municipal wastewater treatment capacity based on known and proven technology and cost-benefit analysis is essential. Local conditions largely determine the best strategy for wastewater treatment. In many locations sewage networks already exist, thus facilitating the adoption of wastewater treatment plants. Other locations still lack these services and the adoption of onsite (anaerobic) treatment of sewage such as septic tanks could be more appropriate, thus leading to cost reductions in the construction and maintenance of the sewage network. Rural areas in developing countries cannot meet current and future sanitation requirements with just one funded project. A comprehensive and long-term strategy that requires extensive planning and implementation phases is vital for sustainable wastewater management [8].

Although sustainable development is a widely recognized concept, it lacks practical approaches to implementation and robust measures of performance and effectiveness, leading to difficulties in its incorporation within specific plans and programs [2]. To attain sustainable development it is imperative to keep a balance between economic, environmental and social demands [16], [17], [26]. An integrated approach accounting for economic development, population management, as well as environmental management is essential, particularly in developing countries. Although information and information sources are rapidly increasing, more often than not, they seem to lack the specific data required for good decision-making and effective resource management [25]. The use of indicators can significantly ameliorate the problem since they provide a means to better organize, synthesize, and use information. Recently, efforts aimed at developing indicators that are suitable for measuring sustainable development have increased. The effects of climate change are also important factors to be considered in order to achieve sustainable water supply and sanitation.

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