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Concepts, Dimensions and Elements of Water Security

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Abstract: Water is an essential element in maintaining life and needed for all social and economic endeavours. However, increase in world population and rapid socio-economic development imposes high pressure on water resources around the world. Therefore, water security is a global concern in recent times. This study aims to focus on various concepts and dimensions of water security. The study also highlights the elements of water security. The paper reviews currently available information on concepts, dimensions and elements of water security. Literatures were identified for review through a comprehensive search by using electronic and non-electronic databases. Literatures demonstrate that water security has multiple definitions depending on the definition of human and/or environmental need. Studies highlighted five key dimensions of water security, namely, household water security, economic water security, urban water security, environmental water security and resilience to water-related disasters. Studies also pointed out three key elements of water security viz. water access, water safety and water affordability. Literatures suggest that investing in water and sanitation and wastewater management will lead to increased levels of human health, reduced levels of poverty and indigence and increased opportunities for education and employment, resulting in overall national economic development. Therefore, mutual cooperation among various countries is urgently needed to achieve water security at national, regional as well as global level.

Key words: Concepts, dimensions, elements, water security

INTRODUCTION

Water is a source of life, livelihoods and prosperity as well as an important input to almost all types of productions viz. agriculture, industry, energy, transport and so on (Grey and Sadoff, 2007). It is an essential element in maintaining life and needed for the survival of all organisms (Azlan *et al.*, 2012). It has been well known for millen-nia that human survival and ecosystem conservation depend on the reliable availability of adequate water of appropriate quality (Asian Water Development Outlook, 2007). Without water, all forms of life could never exist and will not survive. The earth is probably the only planet in the vast universe that has lives on it and the only reason could be that the earth is blessed with abundant water (Zakaria *et al.*, 2011). Water covers 71% of the earth's surface and the existence of water made it possible for different forms of life to breed (Zakaria *et al.*, 2011; Azlan *et al.*, 2012). However, the bulk of the world's surface water (about 98%) exists as salt water in the ocean and seas (Abidin, 2011). Only 2% of the world's water is fresh water found in lakes, inland seas and rivers, of which roughly 99% is either trapped in glaciers and ice caps, held as soil moisture, or located in water tables too deep to access (Chng *et al.*, 2008). Therefore, only about 1% of the world's total freshwater supply is readily available for consumption by humans, animals and irrigation.

Water is increasingly being realized to be the lifeblood of the planet. It is a critical ingredient in all social and economic endeavours. Water plays an equally powerful role through its wide impact on the factors such as food production, hygiene, sanitation and health and the environment. It is well known from prehistoric times that food and agricultural production requires water (Asian Water Development Outlook, 2007). The water-food interrelationships have always been important. Similarly, access to safe drinking water and sanitation lies at the heart of human well-being. Moreover, the development agencies, groups and experts worldwide are increasingly recognizing the important role that water can have on poverty reduction (World Commission on Dams, 2000; Water Supply and Sanitation Collaborative Council, 2000). It is now documented that provisioning of safe drinking water and adequate sanitation services can form the basis for reducing poverty- by improving livelihoods, creating jobs for local communities in developing countries, removing the cycle of diseases that reduce productivity of the people who have limited access to health services and by re-directing the savings in the health sector to other imperatives (UNDP, 2006). Therefore, water plays a central role in the economic growth and sustainable development of a nation. As the world's freshwater supply is finite, demand for water is growing every year due to boom in world

population (Manan *et al.*, 2006). Moreover, socio-economic development requires increased allocations of groundwater and surface water for domestic, agriculture and industrial sectors, which impose excessive pressure on water resources around the world. In addition, water is under threat from depletion, pollution, mismanagement and even from being hijacked by multi-nationals throughout the world (Bouguerra, 2006). The study by Hemson *et al.* (2008) estimated that roughly 166 million people in 18 countries are affected by water scarcity and another 270 million people in 11 countries are water stressed. Other studies also estimated that almost 900 million people worldwide lack access to an improved water supply and 2.6 billion to basic sanitation (WHO, 2010). Two thirds of the world's populations who lack access to improved water supply reside in Asia (Abidin, 2004). The study also reported that about 670 million people in Asia lack access to improved water supply, representing 18% of the total population in the region. Another study revealed that more than 60% of the households in Asia and the Pacific live without safe, piped water supply and improved sanitation (Asian Water Development Outlook, 2013). It was also found that South Asia and the Pacific have the lowest coverage in piped water supply and improved sanitation. Therefore, water security is clearly a global problem in recent times. Currently, achieving water security remains a central challenge for many of the poorest countries in the world (Grey and Sadoff, 2007).

This study aims to focus on various concepts and dimensions of water security. The paper also highlights the elements of water security. Understanding the various concepts, dimensions and elements of water security is essential to reduce its destructive potential and increase its productive potential at national, regional as well as global level.

MATERIALS AND METHODS

This study identified and selected literatures (for review) that focused on concepts, dimensions and elements of water security. Literatures were identified from various sources such as journals, reports, proceedings and related documents by searching comprehensively both electronic and non-electronic databases. Literature searches from electronic databases were conducted mainly on Science Direct, Springer Link, Blackwell and Social Science Citation Index using a range of key words relating to concepts, dimensions and elements of water security. References cited in the literatures were searched and important studies were collected in full text. Websites of the organizations who conduct water related research were also searched to find related documents and reports. In addition, both electronic and non-electronic searches were also supplemented by a network of colleagues who provided related literatures and documents. In the review process, only the

documents written in English were considered. This study reviewed the literatures that included discussions and demonstrated data, findings and evidences related to concepts, dimensions and elements of water security.

RESULTS AND DISCUSSION

This study is based on the information, findings and evidences from published literatures that documented water security either at local, regional or international level. Various concepts, dimensions and elements of water security are discussed below.

Concepts of water security: There is no single, widely accepted definition of 'water security'. Cook and Bakker (2010) highlighted that water security has multiple definitions depending on the definition of human and environmental need. According to Global Water Partnership (2000), water security is an overarching goal where every person has access to enough safe water at affordable cost to lead a clean, healthy and productive life, while ensuring that the environment is protected and enhanced. In the Ministerial Declaration of the 2nd World Water Forum, the term of water security has been defined in a broader aspect to ensure that freshwater, coastal and related ecosystems are protected and improved; that sustainable development and political stability are promoted, that every person has access to enough safe water at an affordable cost to lead a healthy and productive life and that the vulnerable are protected from the risks of water-related hazards (World Water Council, 2000). The study by Grey and Sadoff (2007) has defined water security as the reliable availability of an acceptable quantity and quality of water for health, livelihoods and production, coupled with an acceptable level of water-related risks to people, environments and economies. Water aid (2012) defines water security as reliable access to water of sufficient quantity and quality for basic human needs, small-scale livelihoods and local ecosystem services, coupled with a well managed risk of water-related disasters. According to UNESCO-IHP (2012), water security is the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being and socio-economic development for ensuring protection against water-borne pollution and water-related disasters and for preserving ecosystems in a climate of peace and political stability. The literatures reviewed show that various definitions and interpretations of the term 'water security' exist and use of the term is widespread. However, a mutually agreed-upon definition is needed if water security is to be achieved and provides a shared understanding of the concept and its various complex dimensions.

Dimensions of water security: A few studies have focused on various dimensions of water security. The Asian Water Development Outlook (2013) pointed out

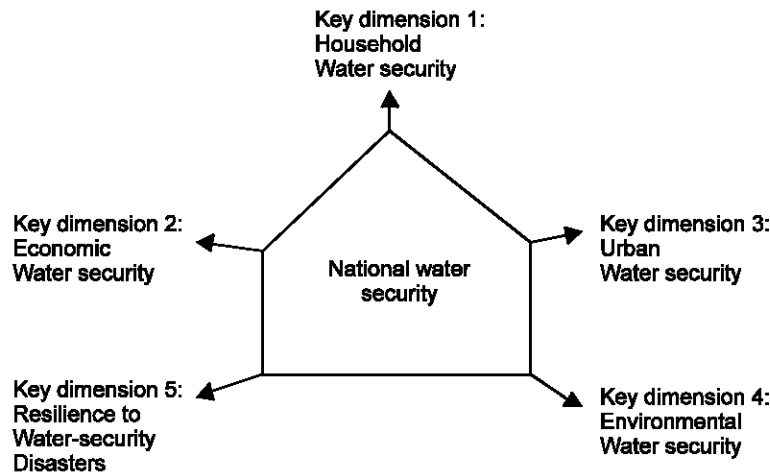


Fig. 1: Key dimensions of water security (Source: Adapted from Asian Water Development Outlook, 2013)

five key dimensions of water security of a country. These five key dimensions measure national water security of a country by focusing on people's lives and livelihoods, with poverty reduction and governance. These key dimensions of water security can be depicted in a frame work as shown in Fig. 1. The dimensions of water security are discussed below:

Household water security: Household water security is the first among the five key dimensions of water security in a country. It includes access to piped water supply and improved sanitation and hygiene at the household level. Providing all people with reliable, safe water and sanitation services should be the top priority of a country. Household water security is vital for a country as it is an essential foundation for efforts to eradicate poverty and support economic development.

Economic water security: The second important dimension of water security for a country is the economic water security. It includes agricultural water security, industrial water security and energy water security. Economic water security measures the productive use of water to sustain economic growth in the food production, industry and energy sectors of the economy. Therefore, the use and supply of water in agriculture, industry and energy sectors of a country must no longer be seen in isolation from each other.

Urban water security: Urban water security is another important dimension of water security particularly in Asia and the Pacific. Nearly 43% of the total population in Asia and the Pacific lives in urban areas and the proportion of urban locality have increased by 29% over the past 20 years (UNESCAP, 2011). Moreover, the cities in Asian countries have become important drivers of the economy in recent years. The urban water security indicators measure the creation of better water management and

services to support vibrant and livable cities. It includes adequate water supply, wastewater treatment and drainage services to the urban dwellers.

Environmental water security: Rapid economic growth in Asia region during the last few decades is imposing negative impacts on the environment and precious natural resources. This is because the governments across the region have prioritized economic development over environmental objectives. Therefore, environmental water security is now a great concern in the region. The environmental water security indicator assesses the health of rivers and measures progress on restoring rivers and ecosystems to health on a national and regional scale. The sustainability of economic development and improved lives depends on the natural resources.

Resilience to water-related disasters: The growing socio-economic development in Asia region has resulted in rapid changes in economic activity, urbanization, diets, trade, culture and communication. Consequently, water-related disasters such as flood, cyclone, typhoon, landslides are occurring frequently in the region. Climate variability and change also contribute to water-related disasters. The resilience of communities in Asia and the Pacific to these changes and especially to water-related disaster risks is assessed with the indicator of resilience to water-related-disasters. The building of resilient communities that can adapt to change and are able to reduce risk from natural disasters related to water must be accelerated to minimize the impact of future disasters.

National water security: The overall national water security of a country is the composite result of the five key dimensions mentioned above. The pentagram of water security (Fig. 1) illustrates that the dimensions of

water security are related and interdependent and should not be treated in isolation of each other. This interdependence indicates that increasing water security in one dimension may affect another dimension of water security. However, the simultaneous increase or decrease in all the five dimensions would affect the overall national water security accordingly. Therefore, the indicators for each of the five dimensions of water security help governments and civil society assess progress toward national water security.

Global Water Partnership (2012) highlighted three dimensions of water security, namely, Social dimensions, Environmental dimensions and Economic dimensions. These dimensions of water security are discussed in brief as below:

Social dimensions: Ensuring equitable access to water services and resources through robust policies and legal frameworks at all levels.

Building resilience in communities in the face of extreme water events through hard and soft measures.

Environmental dimensions: Managing water more sustainably as part of green economies.

Restoring ecosystem services in river basins to increase river health.

Economic dimensions: Increasing water productivity and conservation in all water using sectors.

Sharing economic, social and environmental benefits of transboundary rivers, lakes and aquifers.

Elements of water security: Several studies highlighted the elements of water security. Global Water Partnership (2000) and Bizikova *et al.* (2013) pointed out three elements of water security so that every person can lead a clean, healthy and productive life, while ensuring that the natural environment is protected and enhanced. These elements of water security can be depicted in a frame work as shown in Fig. 2. The elements of water security are discussed below:

Water access: The first element of water security is the water access. It indicates that all the people in a community should have access to water. Water security cannot be achieved if water is only available for part of the year or if water quality is impaired at certain times of the year, for example at the beginning of the rainy season (Water aid, 2012). A water supply must provide reliable access to water of sufficient quantity and quality all year round. An unreliable water supply exposes communities to negative impacts on health and livelihoods. Therefore, water services must be available within or in the immediate vicinity of each household as well as schools, workplaces, health-care settings and public places. Moreover, access must be ensured in a sustainable manner.

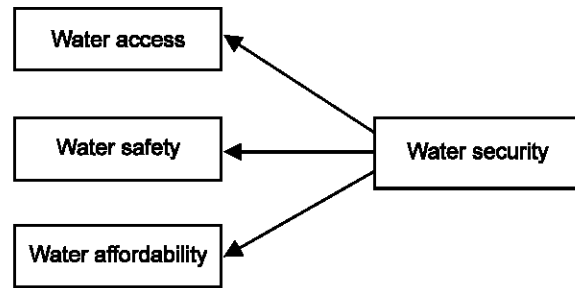


Fig. 2: Elements of Water security

Water safety: The second element of water security is the water safety. There must be sufficient quantity of water to satisfy all personal and domestic needs of the households (UN-Water, 2013). At the same time, water must not pose a threat to human health. In other words, the quality of water should be such that no significant health risk arises from its use. It should be acceptable to users in appearance, taste and odour (Water aid, 2012). Contaminant levels should not exceed the broadly accepted water quality standards of the region or the country where it is consumed. In this regard, sludge and sewage must be properly disposed of to avoid negative impacts on water quality and human health.

Water affordability: Another important element of water security is the water affordability. It means that people should access to safe and sufficient drinking water at an affordable cost in order to meet basic needs, which includes sanitation and hygiene and the safeguarding of health and well-being (United Nations General Assembly, 2010). In this case, regulation has to set standards regarding pricing of water. In other words, water and sanitation services should not be provided for free and tariffs are necessary to ensure the sustainability of service provision (UN-Water, 2013). To meet human rights standards, the essential criterion is that tariffs and connection costs are designed in a way that makes them affordable to all people, including those living in extreme poverty.

Conclusion: The present study reviewed the literatures that focused on various concepts, dimensions and elements of water security. The literatures demonstrate that water security is a serious concern around the world in recent times. Particularly, it remains a central challenge for many poorest countries in the world. Study also shows that water security is not a water sector issue, it is a societal one. The lack of availability and access to basic water and sanitation services impedes individuals and communities from achieving greater levels of well-being and benefitting from opportunities for social and economic development. This is particularly true for the most poor and vulnerable segments of the population, such as women and children. Therefore,

encouraging other sectors to consider water in their policies and planning is the only way to ensure water security. Prioritizing water security through access to water, sanitation and wastewater management leads to greater returns on social and economic growth and development, from the individual to the national level. Moreover, in a globalized world, the issue of water security cannot be addressed by any single country. Therefore, mutual cooperation among various countries is very much needed to achieve water security at national, regional as well as global level. In this regard, knowledge sharing and networking as well as implementing regional technical assistance projects, such as the regional research and capacity development program are particularly required.

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