Physics and Chemistry of the Earth 100 (2017) 258–269

Contents lists available at ScienceDirect

Physics and Chemistry of the Earth

journal homepage: www.elsevier.com/locate/pce

Water security for productive economies: Applying an assessment framework in southern Africa

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ARTICLE INFO

Article history:
Received 14 April 2016
Accepted 25 April 2017
Available online 27 April 2017

Keywords:
Water
Security
Africa
SADC

ABSTRACT

Achieving water security has emerged as a major objective in Africa, yet an analytical or diagnostic framework for assessing water security in African countries is not known to exist. This paper applies one key dimension of the 2016 Asian Development Bank's (ADB) Asian Water Development Outlook (AWDO) to assess levels of water security for productive economies in countries of the Southern African Development Community (SADC). Economic aspects of water security cover four areas: economic activities in the broad sense, agriculture, electricity, and industry. Water security in each area is measured through application of a set of indicators; results of indicator application are then aggregated to determine economic water security at a country-level. Results show that economic water security in SADC is greatest in the Seychelles and South Africa, and lowest in Madagascar and Malawi. Opportunities for strengthening economic water security in the majority of SADC countries exist through improving agricultural water productivity, strengthening resilience, and expanding sustainable electricity generation. More profoundly, this paper suggests that there is clear potential and utility in applying approaches used elsewhere to assess economic water security in southern Africa.

1. Introduction

Water security has emerged as a critical issue of concern in global, regional and national discourses. Globally, water security has featured in the eighth phase of UNESCO's International Hydrological Programme (UNESCO IHP, 2015) and filtered into the conceptualization of Goal 6 of the UN post-2015 Sustainable Development Goal Framework (UN, 2015). The topic also receives prominent focus in the mandates of the Global Water Partnership (GWP), the International Water Management Institute (IWMI), and the World Water Council (WWC). Regionally, SADC's Regional Water Policy (2005) and Regional Water Strategy (2006) reference water security and propose concrete actions to ensure it. African Ministers' Council on Water (AMCOW) outlined a path for strategic engagement to strengthen water security in African countries, calling for adoption of a high-level framework of indicators to enable water security assessment, and identifying several indicators that might be used for this assessment (AMCOW et al., 2012). Further, strengthening water security has been recognized as a regional challenge in SADC countries to meet growing food demand of increasing populations under conditions of climate change (Rampa and Wyk, 2014). Not surprisingly, water security has also received central focus in regional conferences. The 16th WaterNet/WARFSA/GWP-SA Symposium held in Mauritius in October 2015 was focused on "Integrated Water Resources Management and Infrastructural Planning for Water Security in Eastern and Southern Africa."[1]

Despite the growing importance of the topic, an analytical framework for assessing water security in African countries is not known to exist. In the Asia-Pacific, the Asian Development Bank's (ADB) Asian Water Development Outlook (AWDO) developed and applied a water security assessment framework to Asia-Pacific countries (ADB, 2013, 2016). Lautze and Manthrithilake (2012; 2014a; 2014b) also proposed a water security assessment framework and measured water security in Asia-Pacific countries. Two studies have developed and applied water security assessment

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[1] http://www.waternetonline.org/download//data/download/00000032/Final-16th-Symposium-Programme.pdf.

http://dx.doi.org/10.1016/j.pce.2017.04.007
1474-7065/

frameworks at a global scale (Fischer et al., 2015; Sadoff et al., 2015). Fischer et al. (2015) proposed a water security framework consisting of five indicators and applied the framework to 160 countries; the approach was nonetheless somewhat crude as major aspects of water security – such as environment, storage capacity, water supply and sanitation – appear to have been neglected. Sadoff et al. (2015) adopted a risk-based indicator framework with four headline risks and determined water insecurity from an aggregate of 3 economic risks (excluding ecosystem degradation) in selected countries. An in-depth water security assessment of African countries has not been undertaken.

This paper applies the economic water security dimension of the 2016 AWDO framework to assess levels of water security for productive economies in SADC countries. Economic aspects of water security cover four areas: economic activities in the broad sense, agriculture, electricity, and industry. Water security in each area is measured through application of a set of numerical indicators. The results are then aggregated to determine economic water security at a country-level. Structurally, section 2 of this paper reviews definitions of water security and summarizes existing water security frameworks. Section 3 explains the rationale for applying the AWDO framework to SADC countries; introduces AWDO's economic water security dimension; explains the logic of the indicators; and discusses the data sources used. Section 4 presents the assessment results for SADC countries. Section 5 flags some key issues, discusses the utility of applying AWDO Framework to SADC countries. Section 6 provides general recommendations.

2. Background: definitions and frameworks of water security

More than ten definitions of water security now exist (Appelgren, 1997; GWP, 2000; Swaminathan, 2001; WHO, 2003; Cheng et al., 2004; Grey and Sadoff, 2007; Shultz and Uhlenbrook, 2007; Calow et al., 2010; Norman et al., 2011; AMCOW et al., 2012; WaterAid, 2012; Grey et al., 2013; Lankford, 2013; UNU, 2013). While many common elements can be found across these definitions, close scrutiny also reveals noticeable differences in emphasis and breadth. Review of four, more prominent definitions (Box 1), is illustrative of the evolution of the concept over the years. From a base of the first definition (GWP, 2000), risk is added to the second (Grey and Sadoff, 2007), and risk is placed at the center of the third (Grey et al., 2013). The fourth definition (UNU, 2013) represents an encompassing approach to the water security concept and is utilized in this paper.

Box 1
Evolution of water security concepts (2000–2013).

1. Every person has access to enough safe water at affordable cost to lead a clean, healthy and productive life, while ensuring that the natural environment is protected and enhanced (GWP, 2000).
2. The availability of an acceptable quantity and quality of water for health, livelihoods, ecosystems and production, coupled with an acceptable level of water-related risks to people, environments and economies (Grey and Sadoff, 2007).
3. A tolerable level of water-related risk to society (Grey et al., 2013).
4. 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 (UNU, 2013).

Several frameworks to assess water security now exist (e.g. Zeitoun, 2011; Lautze and Manthrithilake, 2012; Mason and Calow, 2012; ADB, 2013, 2016; Lankford, 2013; UN-Water, 2014; Fischer et al., 2015; Sadoff et al., 2015). Zeitoun (2011) identified six elements of a water security "web": Human/Community Security, National Security, Water Resources Security, Food Security, Energy Security, and Climate Security. Lautze and Manthrithilake (2012) proposed five components of water security: basic needs, food production, environmental requirements, risk management and independence. Mason and Calow (2012) developed an overview of a potential framework that covers five themes: resource stress, variability and risk, basic human needs and productivity, environmental needs, and governance. The ADB (2013, 2016) framework contains five key dimensions (KDs): household water security, economic water security, urban water security, environmental water security, and resilience to water-related disasters. Lankford (2013) proposed a two-dimensional framework constructed from "equity" and "sufficiency" based on six indicators. UN-Water (2014) produced a document focusing on "securing water" that makes reference to five pillars: (i) drinking water, sanitation and hygiene, (ii) water resources, (iii) water governance, (iv) water-related disasters, and (v) wastewater pollution and water quality. Fischer et al. (2015) used five indicators, four of which[2] were applied to assess hydro-climatic complexity: (i) total renewable water resources per capita; (ii) the ratio of annual water withdrawal to total renewable water resources; (iii) runoff variability; and (iv) the ratio of external to total renewable water resources. Most recently, Sadoff et al. (2015) proposed a set of indicators to quantify four headline risks: (i) droughts and water scarcity; (ii) floods; (iii) water supply and sanitation; and (iv) ecosystem degradation and pollution.

Four of these frameworks have been applied to assess national water security for sets of countries (Lautze and Manthrithilake, 2012; ADB, 2013, 2016; Fischer et al., 2015; Sadoff et al., 2015). Lautze and Manthrithilake (2012) and ADB (2013, 2016) assessed national water security within and across different water use areas, with focus on Asia-Pacific countries. At a global scale, Fischer et al. (2015) applied quantitative indicators to assess country-level 'economic-institutional capacity' and 'hydrological complexity' in 160 countries and placed countries into one of the four hydro-economic classification groups that correspond to level of water security relative to the economic-institutional capacity. Sadoff et al. (2015) applied risk-based indicators to determine water insecurity across four headline risks in selected countries.

One issue on which there is no definitive resolution in water security frameworks relates to treatment of institutions. The various frameworks currently in use generally include *ends* (i.e. outcomes) of water security such as sufficient provision of household drinking water, yet their inclusion of the *means* (i.e., processes) to achieve water security such as water governance varies. Governance and institutions are clearly important to achieving water security. Nonetheless, it is an open question as to whether these should be part of water security or means to water security. In the AWDO framework, treatment of institutions more closely resembles a discrete means to achieve water security, rather than part and parcel of the concept.

[2] The fifth indicator – GDP per capita – was applied to assess economic-institutional capacity.