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**Kinfu, Yonas; Tiruneh, Nebiyu Daniel**

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# The imperative for establishing a Water Institute of the Greater Horn of Africa

By Yonas Kinfu and Nebiyu Daniel Tiruneh

The Greater Horn of Africa Region (GHAR) which includes Burundi, Djibouti, Eritrea, Ethiopia, Kenya, Somalia, South Sudan, Sudan, Uganda, Rwanda, and Tanzania has a combined population of about 375 million people. Apart from Burundi, Rwanda and Tanzania, the rest are member states of the Intergovernmental Authority on Development (IGAD).

The population of the GHAR suffers from food, energy, and water insecurity despite the potential it has in terms of resources. Water has been identified as an entry point to alleviate poverty, improve the quality of human life, and ensure sustainable economic development. This article contends that the GHAR has a tremendous opportunity to benefit from the water resources it is bestowed with by pulling resources together and establishing a regional water institute.

## Background

Historical records indicate that over the past several centuries numerous water conflicts have occurred across the globe. The global water conflict database maintained by the Pacific Institute<sup>1</sup> has a record of more than 900 conflicts dating back to 3000 BC. The 20th century has witnessed 177 conflicts ranging from small scale tribal conflicts to weaponization of water to attack the enemy and to full-fledged attacks using artillery. Wars were fought over water and the lack of access to water has also resulted in human suffering from hunger, thirst, and spread of water related diseases. The combined stress of global increase in population, which has changed from about 1 billion in 1800 to about 7.7 billion today, and the adverse impacts of climate change has also played a significant role in changing the spatial and temporal availability of water resources. The impacts of climate change and increasing population are becoming causes of concern to the continent of Africa. It is therefore necessary for Africa and Africans to focus on managing their water resources using appropriate technology, sustainable methods, and collaborative efforts.

The success of water resources planning, management, development and operation (including policies and decision-making processes) relies among other factors on the availability of reliable data of sufficient spatial and temporal coverage. Reliable data with appropriate quality control and quality assurance (QC-QA) mechanisms is important in order to have a meaningful data interpretation, data analysis, and modeling. The other key component of a sound water resources management strategy is implementation of appropriate technologies to effectively and sustainably utilize the water resources. Sustainable use and management of water resources is a cornerstone for sustainable development which Africa and Africans need desperately. Institutional capacity plays a critical role in ensuring the success of regional integrated water resources management policies and strategies. In the case of Africa and GHAR in particular, regional and international organizations such as IGAD, the African Ministers' Council on Water (AMCOW), the International Association

for Hydro-Environment Engineering and Research (IAHR), UN-Water, and the Stockholm International Water Institute (SIWI) can play critical roles in narrowing skill gaps that exist between institutions, government entities, practitioners, academicians, experts and other professionals of the GHAR member countries involved in the various sectors of water resources, energy, food security, and sustainable development.

Water resources development provides an impetus for economic growth, and overall improvement in the quality of lives. Over the last few decades the nexus between food, energy, and water systems (FEWS) has been demonstrated with substantial data and analysis. Scientific understanding of the FEWS nexus is of growing importance, even more so as humanity is facing emerging challenges from global environmental change. Experience has shown that several important decisions that influence the FEWS nexus are made by national as well as regional decision makers. Since the FEWS nexus is not necessarily bound by geographical boundaries, regional planning and implementation of FEWS management is shaped by national and global dynamics that include changes in the socioeconomic and technological sectors as well as the dynamics in the regional and international trade and business activities. In the context of global issues such as climate change, economic growth, and the sustainable development goals (SDGs), it is clear that the ability of nations to achieve these broader societal goals is strongly influenced by regional decisions.

In addition to the food and energy systems, the water sector is also interconnected with various other sectors such as health (water supply, sanitation, hygiene, and epidemiology), environmental protection, watershed management, and ecological (bio-diversity) preservation.

As a result, this article proposes the establishment of a water institute that focuses on serving the GHAR by building upon existing institutional capacities. **Figure 1** shows the various sectors that are interconnected with the water sector and how the proposed water institute can become a core component of the system.

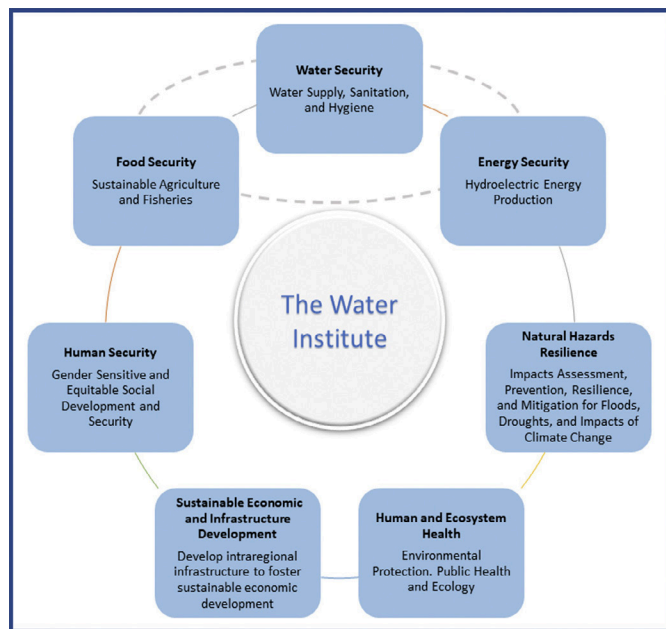


Figure 1 | Thematic interconnectivity of the Water Institute with other sectors.



Figure 2 | The Greater Horn of Africa Region.

### Assessment of Existing Water Resources Related Institutions

A map with the GHAR is shown in Figure 2. Table 1 provides population and water-related data for the region. In addition, Figure 3 shows water falls on River Nile (called Abay in the local language), which is one of the major rivers in GHAR.

Variable Name	GHAR Country					
	Burundi	Djibouti	Eritrea	Ethiopia	Kenya	Rwanda
Total population (1000 inhab)	10827.02	944.099	3412.893	106399.9	50227.14	11980.90
GDP per capita (current US\$/inhab)	296.1105	2891.235	1169.566	731.5802	1584.66	748.350
Human Development Index (HDI) [highest = 1]	0.421	0.492	0.431	0.467	0.574	0.529
Surface water produced internally (10 <sup>9</sup> m <sup>3</sup> /yr)	10.06	0.3	2.7	120	20.2	9.5
Groundwater produced internally (10 <sup>9</sup> m <sup>3</sup> /yr)	7.47	0.015	0.5	20	3.5	7
Total renewable surface water (10 <sup>9</sup> m <sup>3</sup> /yr)	12.536	0.3	7.215	120	30.2	13.3
Total renewable groundwater (10 <sup>9</sup> m <sup>3</sup> /yr)	7.47	0.015	0.5	20	3.5	7
Fresh surface water withdrawal (10 <sup>9</sup> m <sup>3</sup> /yr)	—	0.001	—	—	3.507	—
Fresh groundwater withdrawal (10 <sup>9</sup> m <sup>3</sup> /yr)	—	0.018	—	—	0.525	—
Total population with access to safe drinking-water (%)	75.9	90	57,8	57.3	63.2	76-1
Variable Name	Somalia	S. Sudan	Sudan	Tanzania	Uganda	
Total population (1000 inhab)	14589.18	10910.76	40813.4	54660.34	41166.59	
GDP per capita (current US\$/inhab)	101.5634	606.0064	3059.744	954.8774	634.7691	
Human Development Index (HDI) [highest = 1]	—	0.414	0.507	0.522	0.522	
Surface water produced internally (10 <sup>9</sup> m <sup>3</sup> /yr)	5.7	26	2	80	39	
Groundwater produced internally (10 <sup>9</sup> m <sup>3</sup> /yr)	3.3	4	3	30	29	
Total renewable surface water (10 <sup>9</sup> m <sup>3</sup> /yr)	14.4	49.5	35.8	92.27	60.1	
Total renewable groundwater (10 <sup>9</sup> m <sup>3</sup> /yr)	3.3	4	3	30	29	
Fresh surface water withdrawal (10 <sup>9</sup> m <sup>3</sup> /yr)	3.167	—	—	—	—	
Fresh groundwater withdrawal (10 <sup>9</sup> m <sup>3</sup> /yr)	0.131	—	—	—	—	
Total population with access to safe drinking-water (%)	31.7	58.7	55.5	55.6	79	

Table 1 | Population and water-related data of the GHAR for 2017<sup>2</sup>





**Figure 3** | Blue Nile (Abay) Waterfall [Tis Esat] about 30 km from Lake Tana.

A general and simplified assessment of the water resources related institutions within the IGAD countries was performed to identify possible gaps that exist and therefore inform the establishment of the proposed water institute. The countries included are Ethiopia, Kenya, Sudan and Uganda. Regarding the other IGAD countries of Djibouti, Eritrea, Somalia and South Sudan, no substantial water resources institutions were identified.

In Ethiopia, the two major water resources related institutions are: **1** | Ethiopian Institute of Water Resources (EIWR) and **2** | Water & Land Resource Centre (WLRC) established in 2011, and associated with Addis Ababa University.

EIWR is a higher education institution mainly engaged in training water professionals and community outreach in the management of water resources. WLRC's main engagement is in water resources as it relates to land management with primary focus on addressing sedimentation within catchments.

In Kenya, the following four water resources related institutions were identified:

- Kenya Water Institute (KEWI) (established in 2001 by act of government);
- Water Resource and Research Center (WRREC) (hosted by Jomo Kenyatta, University of Agriculture and Technology and supported by Ministry of Water and Irrigation since 2011)
- Institute of Environment and Water Management (IEW) (established in 2005)
- Kenya Climate Innovation Center (KCIC) (established in 2012)

The mandate of KEWI is to offer training, administer examinations, and involve in research and consultancy services in the water sector. Training and consultancy services seem to be the focus of KEWI because it has to generate income to support itself.

WARREC is setup to encourage and facilitate research (the use of science, technology, and innovation) and to build the capacity of water related stakeholders and has a slight academic slant. The focus of IEW in water resources seems to be related to women's participation; capacity building through training and forums; and dissemination of information; and excludes hardcore science and engineering aspects of water resources development. KCIC's focus to provide solutions to climate change impacts in relation to energy, water and agribusiness.

In the Sudan, the major water resources institution is the Water Research Centre (WRC) that was established by the University of Khartoum in 2009. The main focuses of the Center are research and development, training, providing advice to policy makers and stakeholders and technology transfer in relation to water and the environment. Because the Center is structured under a faculty of engineering, it appears to have an academic slant and focus on training activities. In fact, it receives students from the region for training in water resources.

In Uganda the major and leading water resources related institution is The Appropriate Technology Centre for Water and Sanitation (ATC), which was established by Ministry of Water and Environment. ATC's main focus is research and the implementation of appropriate technology in relation to water supply and sanitation, with some engagement in irrigation works.

Based on the country-by-country assessment it was found that the various water resources related institutes and centers within the IGAD countries have different emphasis, scope and context. None of them have an all-encompassing program on water resources related themes. The proposed water institute is expected to encompass a wide range of water related activities as outlined in this article.

## Motivation

The need for the proposed water institute became apparent while attempting to find hydro-meteorological data in the region. Neither raw nor processed data were readily available to be used for analyses. This experience resulted in informing the following three main motivations that form the basis for the formation of the proposed water institute are described as below:

1 | Preliminary assessment of technical capabilities in the GHAR indicate that there is a shortage of systematically organized, quality controlled, and readily accessible water resources data for use in formulating policies, planning, and design of water infrastructures. As a result, there is an emerging need to address the shortage of valuable water resources data necessary to implement a sustainable water resources management plan. In addition, data deficiencies and uncertainties are inextricably linked to improper designs resulting to incorrect capacity, shorter design life span, inflated project cost and unduly longer design and construction schedules of civil infrastructures.

2 | There is an urgent need to effectively mobilize and utilize resources with backing by the political establishment of member states in order to implement sustainable development of water resources with a shared vision and common goal.

Africa needs to reverse the current trends of endemic poverty, extreme underdevelopment and migration of its younger population in search of a better life. The role of water in helping achieve the desperately needed socio-economic development goals is well understood. Notwithstanding the issue of spatial and temporal distribution, Africa has the benefit of substantial rainfall and water resources. However, Africans still face a myriad of severe and intricate natural and man-made problems that have put significant constraints on the sustainable development of water resources in many parts of the continent.

In an attempt to map a chart aimed at utilizing water as a driver to the challenges Africa is facing, the UN-Water/Africa produced a report in 2004 (in collaboration with other African-related organizations) titled "The Africa Water Vision for 2025: Equitable and Sustainable Use of Water for Socioeconomic Development"<sup>3</sup>.

The report outlines human threats to the sustainability of water resources which include inappropriate governance, depletion of water resources, failure to invest in resource management, unsustainable financing.

In addition, the report states the key water resources related challenges Africa faces. Those that are relevant to the proposed water institute, such as reforming water resources institutions to establish good governance, securing and retaining talent, developing research and development capability, outlining strategies to tackle water security threats and mobilization of political will.

The 2012 Status Report on the Application of Integrated Approaches to Water Resources Management in Africa prepared with information contributed by the member states of AMCOW<sup>4</sup> provides key messages and recommendations based on the survey it conducted. Those among them that are relevant to the proposed water institute are lack of financing of water resources

management, lack of progress in the development and implementation of transboundary agreements and institutional capacity constraints.

3 | A careful examination of individual country experiences demonstrates that there is a clear and demonstrable gap in the areas of shared knowledge and technical resources necessary to manage water resources sustainably. It is apparent that organizations such as IGAD, AMCOW, IAHR, UN-Water and SIWI can play a crucial role in bridging this gap. Through consultation and a shared vision, such organizations can create a paradigm shift by establishing a shared platform for regional integrated water resources planning and management through regional cooperation and by building the technical know-how and enhancing infrastructural, and technical resources mobilization in the Greater Horn of Africa Region.

Establishing a water institute as a Technical Center of Excellence will help coordinate efforts, provide technical support, assess performance, map future paths, and make the task of accomplishing the ideals identified above achievable. **Figure 3** illustrates the thematic connectivity of the proposed water institute with other sectors of human welfare and development.

## Vision and Objectives

The vision of the proposed water institute is to establish a center of excellence to help sustainably manage the water resources of the countries of the GHAR by creating a mechanism that facilitates integrated planning, management and development of water resources and other critical water infrastructures by considering the impacts of climate change and other stressors. The institute would be a technology driven powerhouse and repository, that systematically and seamlessly integrates data and methods for management of water resources and timely exchange of data and information. The institute will adapt, innovate and create appropriate technologies and enhance efforts to bridge gaps through knowledge transfer, capacity building, and cooperation among GHAR countries. The institute would also provide leadership, training, research, as well as best practices and knowledge transfer services to member states of GHAR. The objectives of the proposed water institute would be:

1 | Facilitate the establishment of data collection systems; perform data processing and analysis, and dissemination of water-related data and information.

2 | Conduct applied research and development activities to address and amicably resolve water resources related issues identified in the region.

3 | Create a platform for knowledge transfer and adaptation of appropriate technology.

4 | Perform water resources systems modeling and simulations that include both physical and numerical modeling of processes, natural features, and engineered structures.

5 | Facilitate and support the coordination of planning, management and development of transboundary water resources including river basins, lakes and aquifers.

### The rationale for establishing a Water Institute

There are two underpinning rationales that demonstrate the benefits of the proposed for the GHAR region:

- 1 | The proposed water institute would create an enabling environment that fosters cooperation and the institutional setup to help improve the livelihood of people in the region and strengthen regional peace and security.
- 2 | The proposed water institute would help bridge existing gaps in technical and scientific capacities in the area of water resources management by pulling together resources from the region. The Institute would also provide a platform for sharing experiences, lessons-learned and coordination on climate change related issues.

The need to establish the proposed regional water institute rests on the following two main reasons:

- 1 | The need to develop an integrated water resources planning, management and development within the GHAR countries, given that the water sector is a critical component of any economic development.
- 2 | The contribution the institute would make in the economic cooperation/integration of the Greater Horn of Africa Region.

Most of the major river basins and aquifers within the GHAR countries are transboundary in nature because political boundaries rarely follow basin or aquifer divides. The transboundary basins in the GHAR include White Nile/Lake Victoria, Omo River/Lake Turkana, Wabi Shebelle River, and Tekeze River. In addition, some of the trans-boundary aquifers are Rift, Dawa, Gedaref, Sudd basin and Awash Valley. The development of a river basin by an upstream country influences water availability in the downstream countries. In addition, the same is also true for flooding and water quality. Any water quality degradation and improper watershed management by an upstream country has an adverse effect on the downstream countries. Because of the highly interconnected nature of basins and aquifers between countries, the need to develop a framework for an integrated water resources planning, management and development amicably within GHAR countries is critical. Transboundary basins and aquifers have to be managed proactively so that any differences do not lead to conflict threatening peace and stability in the region.

The establishment of the proposed water institute is expected to contribute to the economic cooperation/integration, development, and stability of GHAR. Recent economic trends indicate that Africa’s economy, and more specifically the GHAR, is experiencing growth in economic and infrastructural development. (Africa’s and East Africa’s (GHAR countries and the Comoros and Seychelles) GDP growth rates are projected to reach about 4.6% and 5.6% in 2022, respectively<sup>5</sup>. Infrastructure investment in Africa is expected to reach about \$149 bn in 2022<sup>6</sup>.) In addition, there seems to be a desire for a broader economic cooperation/integration within the GHAR. Economic cooperation/integration entails building institutional capacities and legal frameworks that would facilitate the collaboration and coordination of various economic and technical activities among member countries. The proposed water institute would facilitate the economic cooperation/integration by providing a suitable platform for the development

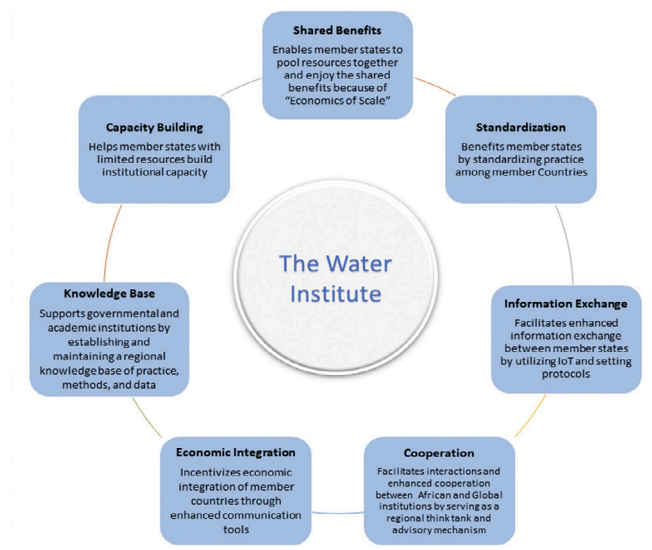


Figure 4 | Potential benefits of the Proposed Water Institute.

of the water sector that is a critical component of an overall economic development. Economic cooperation/integration in turn is expected to lead to peace and stability, which in turn is a prerequisite for an economic growth.

### Summary and Conclusions

This proposal calls for the establishment of a regional water institute for the Greater Horn of Africa Region, either under the auspices of IGAD or any other regional organization, with support of international organizations such as UN Water and scientific and engineering associations such as IAHR. The water institute would serve as a technical center of excellence for the region in regards to the water sector. The institute would serve as a "clearing house" for water resources related data, foster collaboration with the states in the region, provide technical capabilities, and serve as a think tank on water related policies.

The establishment of the water institute is expected to contribute to the economic cooperation/integration and stability of the region. Wider economic cooperation/integration within the region is possible, notwithstanding some political hiccups.

A regional approach is considered to be more suitable than developing a pan-African organization. Africa is a big continent with unique and diverse regional features. As a result, organizing the water sector at regional level is advisable. Since the water sector is interconnected with various other sectors and social organizations, the proposed water institute is expected to interface both internally within governmental entities and externally with NGOs, international and regional organizations.

Some challenges are expected in reaching a consensus and establishing the proposed water institute. The expected challenges may include financing naming of the water institute, choosing a location (or locations) for the institute and staffing arrangement, including leadership positions. However, to overcome these challenges trust must be developed among the different countries within the GHAR to garner goodwill. For the proposed plan, the coordinating body that would facilitate the establishment of the water institute should be seen as impartial and acceptable to all.



**Yonas Kinfu**

Yonas Kinfu is currently a hydraulics & hydrology technical specialist with Bechtel. He obtained his PhD from the University of British Columbia (Canada) in Civil Engineering (Hydrotechnical) in 1999. His expertise includes hydrologic and hydraulic engineering and modeling, including flood hazard analysis, hydraulic transient analysis and hydrodynamic modeling of water quality in receiving waters such as rivers and coastal areas, and hydraulic structures. He is a member and past chair of the Computational Hydraulics Committee of EWRI/ASCE.

**Nebiyu Tiruneh**

Nebiyu Tiruneh is a hydrologist with undergraduate training in hydraulic engineering and graduate training in water resources and hydrology. His doctoral research focused on assessing impacts of climate change and sea level rise on coastal aquifers. His areas of expertise include numerical modeling, application of GIS and remote sensing, assessing impacts of climate change on water resources, and assessment of natural hazards on infrastructure. He works as a hydrologist for the Federal Government and also serves as an adjunct associate professor at the University of Maryland Global Campus where he teaches graduate and undergraduate courses on water resources and global environmental change.

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