



شبكة المعلومات الجامعية
التوثيق الإلكتروني والميكرو فيلم

بسم الله الرحمن الرحيم



HANAA ALY



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التوثيق الإلكتروني والميكروفيلم



شبكة المعلومات الجامعية التوثيق الإلكتروني والميكروفيلم



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جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

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FRAMEWORK FOR ASSESSMENT OF THE NATIONAL WATER SECURITY WITH APPROPRIATE INDICATORS IN EGYPT

A Thesis submitted in partial fulfilment of the requirements of the degree of
Doctor of Philosophy

by

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

"قَالُوا سُبْحَانَكَ لَا عِلْمَ لَنَا إِلَّا مَا عَلَّمْتَنَا
إِنَّكَ أَنْتَ الْعَلِيمُ الْحَكِيمُ"

صَلَّى
الْعَظِيمِ

الآية رقم (٣٢) من سورة البقرة



Ain Shams University- Faculty of Engineering
Irrigation & Hydraulics Department


AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING
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This thesis is submitted as a partial fulfilment of Doctor of Philosophy in Civil Engineering Engineering, Faculty of Engineering, and Ain shams University.

The author carried out the work included in this thesis, and no part of it has been submitted for a degree or a qualification at any other scientific entity.

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Signature

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Date: 25th December 2021

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THISIS SUMMARY

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Thesis Title: FRAMEWORK FOR ASSESSMENT OF THE NATIONAL WATER SECURITY WITH APPROPRIATE INDICATORS IN EGYPT

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Water is the source of life and the main input in nearly every socio-economic activity. Egypt faces great challenges, fixed share of Nile water, imitated of groundwater, imitated of rainfall, in addition to the effect of climate change on water availability. Population rapidly increase and, with this limited water resources the gap between water resources and demand is growing.

Commonly used water status evaluation approaches such Water Scarcity, Water Stress and Water Poverty indicate that Egypt water situation is getting worse under these challenges, and does not provide tools to guide or achieve improvement in water management to better utilize available resources and secure the growing demands. This is logic because all of these approaches focus on the supplied water resources volume, which is limited in our case of Egypt. Also these approaches do not say anything about water quality, water use efficiency, water productivity, etc.

With the growing global Water Scarcity in many places around the world, the Water Security approach and the Water Security Index (WSI) is becoming attractive tool for evaluating and monitoring progress in water management. Water Security Index is not only a tool to estimate the current situation but we can use it also to give water mangers a tool for future strategic planning and to define measures and actions which have to be taken to enhance the water situation.

The main objective of this research is to introduce methodology to evaluate water security in Egypt according to local conditions and under the above mentioned challenges and to give the water mangers a tool to be used to enhance water security. Water Security in Egypt has not been assessed or quantified before in a way that enables water managers to have

an outlook for future situation to achieve water security in a comprehensive way. In the current research, a framework to assess WSI is developed to provide water managers with guidelines to enhance the current and future situation and to identify the strengths and weaknesses in water management process.

The thesis started by using the Asian Water Development Bank Outlook "AWDO" methodology, which is widely used by almost all Asian countries and applied by the international community. The water security index of AWDO is assessed based on five key indicators reflecting all issues related to water management (household water security, economic water security, urban water security, environmental water security, resilience to water-related disasters). Data of 2020 is employed to calculate the water security index for Egypt which was found to be at moderate level and huge efforts are needed to enhance this index in order to face the current water challenges. Also, several measures are identified in our research to raise the WSI score and to enhance the water security situation in Egypt.

In order to have realistic representation and to accurately calculate the WSI for Egypt under our local conditions, some modifications are introduced to the well-known AWDO methodology. In the current research a new framework is modified and developed, which is suitable to the Egyptian case and the available data. Main modifications for the newly developed WSI for Egypt included (Water availability, Water productivity, water-related disasters, Environmental water security and State Capacity). Targets are set in accordance to the SDGs 2030 for each of the key indicators that can raise the WSI score to ensure compatibility with the SDGs 2030 goals. The modified Water Security Index methodology under the Egyptian local conditions is also used to predict the Water security index for the year 2030 based on assumed projections for several water shortage scenarios. These future scenarios helped in drawing a road map for necessary measures needed to secure the water situation and consequently the economic growth.

In addition to that, the current research applied a Decoupling model for Egypt and calculated the Decoupling Index (DI) for Egypt using the 2020

data. Decoupling refers to the economy's ability to grow without negative environmental impacts. Decoupling is an important tool to test water technologies, and measures of the National Water Resources Plan of Egypt to enhance the water security by analyzing the relationship between economic development and water consumption. This thesis identifies some technological solutions and measures that contribute to the implementation of decoupling policy in agricultural, industrial and domestic water sectors.

The overall results in this study indicates that the proposed framework is capable for quantifying the water security of a river basin considering all aspects and taking into consideration the blue and grey water footprint. In addition, the results from the proposed framework guide the water management and monitor its progress towards a defined target.

By accurately evaluating and predicting water scarcity and droughts, the decision makers can improve efficient water management plans and proactive mitigation to minimize social, environmental and economic impacts significantly. The overall Water Security Index can be improved by enhancing KD4 and KD5 through adoption of measures to enhance water quality, reduction of pollution, and enhance governance in water sector. It is strongly recommended to evaluate this index periodically to monitor progress in water security and define strengths, weakness or shortcomings.

Key words: Egypt, Water Security, Water Security Index, Decoupling

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