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Applications of Water Footprint Methodology as a Decision Support Tools for Water Allocation/Management Tasks in Egypt

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Abstract

Water-poor countries are in pressing need to manage their water needs (real and virtual forms). The aim of this article is to introduce a new modeling approach for the analysis and possible management of both real and virtual water at a national scale. Therefore, it should be possible to assess the virtual water trade with the rest of the globe, and the projected changes in imports and exports under different national and global scenarios. Considering the case of Egypt, a water-poor country, a major food importer, and the world's largest wheat importer, to exemplify the development of a national water, food, and trade (NWFT) modeling framework. The framework includes a system dynamics model of national water-food supply, demand, and a gravity model of international virtual water trade, running in parallel for analysis and comparison. The article introduces the Life Cycle Assessment LCA, and its relation to water footprint. Also represents a modeling framework for the analysis of real and virtual water flows at national scale. The framework has two components:

(1) A national water model that simulates agricultural, industrial, and municipal water uses, available water, land resources; and

(2) An international virtual water trade model that captures national virtual water exports and imports related to trade in crops and animal products.

This National Water, Food & Trade (NWFT) modeling framework is applied to Egypt, and the world's largest importer of wheat. Egypt's food, water gaps and the country's food (virtual water) imports are estimated over a baseline period (1986–2013) and projected up to 2050 based on four scenarios. Egypt's food and water gaps are growing rapidly as a result of steep population growth and limited water resources. The NWFT modeling framework shows the nexus of the population dynamics, water uses for different sectors, and their compounding effects on Egypt's food gap and water self-sufficiency. The sensitivity analysis reveals that for solving Egypt's water and food problem non-water-based solutions like educational, health, and awareness programs aimed at lowering population growth will be an essential addition to the traditional water resources development solution.

Keywords: Water Security, Life Cycle Assessment (LCA), Water Footprint, Virtual Water Trade, National Water, Food & Trade (NWFT); Food Consumption,Water Resources System, Agricultural Production, Future Scenarios.

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