A Novel Approach to Energy-Water-Food (EWF) Security Nexus

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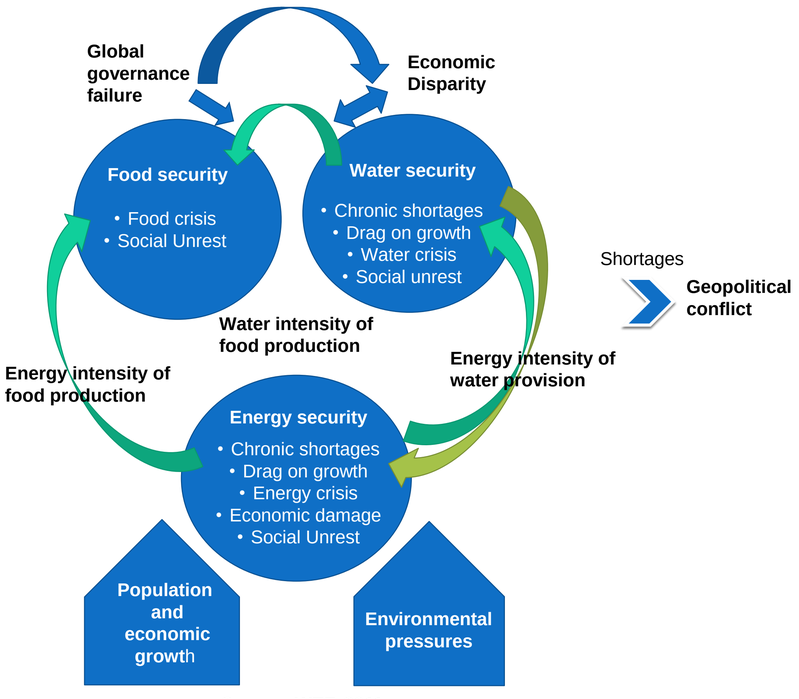
INTRODUCTION

Energy, food, and water are intrinsically interlinked with each other. Commonly termed as the 'nexus', these linkages are also associated with wider socio-economic and environmental components. Not many comprehensive studies on the EFW nexus exist globally, or even at national level at which most resource security policies are framed. Most of the current understanding, being at micro level generally; is based on the physical linkages between the resources. This also entails partial coverage either in terms of analysing all three resources along with the broader socio-economic and environmental context, or consideration of other much relevant perspectives including policy, institutional, governance, etc. India—an emerging global economy, characterized by rapid urbanization, industrialization, changing consumption patterns, and rising consumerism; is likely to more put more pressure on existing food, water, and energy resources in the future to support the rapidly growing population and therefore the inter-linkages discussed hitherto need an inclusive treatment at the national level in Indian context.



Source: WEF, 2011

RESEARCH OBJECTIVE

The key objective of the overall research is:

To understand the inter-linkages between food, water, and energy securities, with a view to facilitate more informed, integrated and comprehensive approach to policy making in the context of EWF security in India.

However, objectives pertaining to the methodological component of the research are:

a) To develop and use a unique modelling framework that allows analysis of trade-offs and synergies resulting from scenarios driven by nexus and non-nexus based security considerations.

b) To analyse the impact of alternative policy and developmental trajectories on economic, social, and environmental indicators.

METHODOLOGY

The methodology adopted for this component of the research to achieve the above-mentioned objectives essentially entails soft-linking a top-down Input-Output model with the bottom-up MARKAL model with special focus on energy, food, and water sectors.

Core Methodological Framework

MARKAL (Bottom-Up)

- Detailed description on energy producing and consuming technologies
- Least-cost solution to meet energy demand
- Provision of constraints—Supply, capacity, emissions, etc.

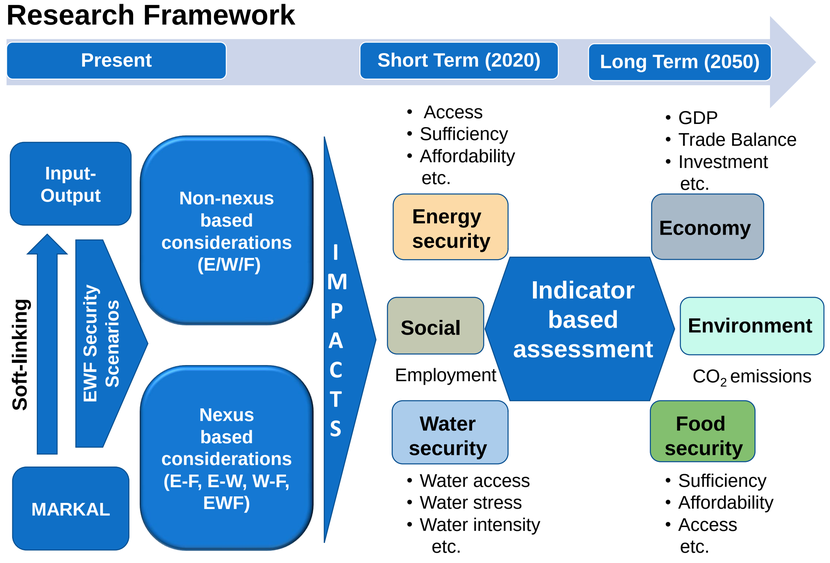
INPUT-OUTPUT (Top-Down)

- Provision of introducing flexible production functions to assess the impacts of input substitutability
- SDA*—Examination of structural changes --direct & indirect input-quantity or input-price components and technological change effects

- Allows examination of the economy-wide, social and environmental impacts of sectoral policies and strategies aimed at redressing the energy-food-water security challenge backed by technology, price, input factors substitution (using flexible production functions), and environmental targets.

*Structural Decomposition Analysis

Research Framework



Apart from the individual advantages that each of the model offers, the purpose of soft-linking the two is to enhance the technological richness of a top-down economic model using bottom-up engineering information (Mcfarland et al., 2004) to improvise economic input-output model results.

Further, this integration will allow comparison between different policy options backed by technological interventions, input substitution, environmental targets, etc. with the help of scenario analysis, which will demonstrate policy trade-offs or synergies in the use of resources for satisfying energy, food, and water demands by assessing their economy-wide impacts (including on energy, food and water security) both in the short and long term.

EXPECTED OUTCOMES

The research is expected to deliver:

a) Important insights into potential policy trade-offs and synergies involved in short and long-term energy, food, and water security.

For instance, examination of energy, food, water security levels, socio-economic, and environmental impacts and their associated trade-offs or synergistic effects corresponding to business-as-usual policies, energy security oriented policies (e.g. fuel substitution, energy efficient technologies, etc.) and EWF nexus informed energy security policies (e.g. improved agricultural practices that require less energy and water inputs) can be performed to compare policy outcomes.

b) A multi-dimensional perspective on EWF security challenge for India informed by context-dependency and interconnectedness of security constructs. This approach, it is contended, will provide a more informed, integrated, and comprehensive basis for policy development to redress the energy, food, and water security challenge in the Indian context. Beneficiaries include policy makers, planners, researchers, governments, business communities, investors and community at large.

The author is a PhD student under the Joint degree programme between TERI University and University of Technology, Sydney

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