ASSESSING THE STATE OF THE WATER-ENERGY-FOOD (WEF) NEXUS IN SOUTH AFRICA

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The Land-Water-Energy nexus and the Sustainability of the Food System
• **Background and Significance**

  - Sustainable resource management is a major world-wide governance concern.
  - Integrated Water Resource Management (IWRM) is *water-centric*, while the WEF Nexus has a *polycentric* philosophy.
  - The WEF nexus is closely aligned to the SDGs 2, 6 and 7.

• Nationally

- Most **information** is available at a **sector-specific** level
- The WEF nexus is currently being investigated by several universities and institutions in South Africa (UKZN, UCT)
- South Africa is one of the most advanced countries in terms of achieving the targets set in the three relevant SDGs (i.e. 2, 6 and 7)
CURRENT STATUS OF THE WEFT NEXUS IN SOUTH AFRICA

• Provincially

- The sustainability of exporting ‘virtual water’ in agricultural products need to be evaluated
- The Northern Cape’s agricultural land is reduced by the colonisation of alien invasive plants
- Water resource systems and the supporting infrastructure within the Karoo are extremely strained

https://www.researchgate.net/publication/320670915_INVASIVE_PLANT_SPECIES_IN_LESOTO%27S_RANGELANDS_SPECIES_CHARACTERIZATION_AND_POTENTIAL_CONTROL_MEASURES/figures
\textbf{Policy Frameworks}

- South Africa faces a mounting challenge to secure a supply of clean water, to protect water resources and to eradicate hunger and poverty.

- Progressive policies and sector-specific laws need to be properly \textit{aligned with the constitution for synergy}. 

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IMPLEMENTING THE WEF NEXUS IN SOUTH AFRICA

• Technical Level
  ▪ Green technology and infrastructure will influence resource availability in South Africa
  ▪ Many opportunities exist that could enhance the evolution of the WEF Nexus
  ▪ South Africans need to be educated and informed
  ▪ There is potential for improving data collection, as well as the documenting, visualising and sharing (cohesion between research groups)
  ▪ South Africa has great potential for renewable energy

https://www.gauteng.net/attractions/menlyn-maine-hub-brings-sustainable-city-living-to-pretoria
• **Policy Level**

  - Multi-stakeholder dialogues are needed
  
  - There is scope for improvement for information and interest to be generated at a technical level
  
  - Work is also required to present the WEF nexus better at a regional level
  
  - Policy-making processes need to consider the adverse effects of climate change

https://theforestsdialogue.org/process
POLICY AND RESEARCH GAPS

- Previously, natural resources management and environmental issues were mainly discussed by engineers and environmental scientists.

- The exclusion of policymakers and other stakeholders creates a large gap of knowledge.

- The development of WEF nexus policies requires sustainable resource planning and management through a central authority.

- Interdisciplinary studies between water, energy and food security are needed to address the knowledge gap, which is required for policy formation.

- In South Africa, the disconnection between three sectors is apparent.

- National policies lack convergence.
A total of 20 WEF Nexus frameworks were reviewed and a criteria was used to assess if the frameworks had the following characteristics,

a) Inclusion of all three sectors
b) Mentioned major drivers of change
c) Applicability to South Africa
d) Integration of other sectors
e) Connection to SDGs
f) Innovations strategies

Based on the above criteria, five existing frameworks were identified
A PROPOSED WEF NEXUS FRAMEWORK FOR SOUTH AFRICA

Drivers/Challenges
- Climate Change
- Population Growth
- Urbanisation
- Demand and consumption
- Resource degradation & scarcity
- Economic development
- Land use change
- Pollution
- Science-culture socio-politics
- Science and technology

Finance

Governance
- Policies & Strategies

Outcomes & Goals
- Innovations
  - Renewable energy technologies (biofuels, wind, solar, tidal)
  - Efficient water-use (desalination, dry-cooling power plants, recycle and reuse)
  - Improved infrastructure
  - Technological advances (data access and sharing)
  - Seasonal climate forecasts (climate change adaptation)

A Sustainable Environment & Human Well-being
- Eradication of hunger (nutrition & food security)
- Improved health & well-being
- Access to clean water & sanitation
- Access to modern, clean & affordable energy
- Improved livelihoods
- Environmental quality
- Economic growth

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Indices, metrics and models are used for evaluating and quantifying the WEF nexus

It is useful to generate data that will be able to quantify flows of energy and materials, make numerical predictions and estimate the associated costs.

WEF NEXUS CHALLENGES

• Key Challenges:

1. Poor education, urbanisation, and poverty
2. Culture and politics
3. Climate change in South Africa
4. Access to and distribution of data

http://bush.tamu.edu/istpp/nexus/
CONCLUSIONS AND FUTURE WORK

- The review consolidated the available knowledge of the WEF nexus in South Africa, with a focus on its current status, challenges, and opportunities for intersectoral planning, at a technical- and policy-level.

- Policy and research gaps were identified, and WEF nexus research champions were acknowledged.

- There are multiple models, tools and indices available to evaluate and quantify the WEF nexus; however, they may require modifications to be applicable to South Africa.

- A WEF nexus framework was developed with emphasis on SDG’s 2, 6 and 7.

- Future research projects may consider involving all parties (policymakers, researchers, and stakeholders) when developing policies.
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