

11-12 FEBRUARY 2025

RABAT, MOROCCO

Institut Agronomique et Vétérinaire Hassan II



WEFE NEXUS INTERNATIONAL CONFERENCE

**EXPLORING AND BRIDGING NEXUS FOR
A SUSTAINABLE FUTURE**



These projects are part of the
PRIMA programme supported
by the European Union.



WEFE NEXUS INTERNATIONAL CONFERENCE

Day 2 – 12th February 2025

PILLAR 3: WEFE NEXUS SOLUTIONS

CHALLENGES AND OPPORTUNITIES FOR WEFE NEXUS SOLUTIONS.



KEYNOTE SPEECH I

Multicounty experiences with trade-off analysis
and WEFE Nexus

Prof Bassel Daher

Assistant Director for Sustainable Development
Texas A&M Energy Institute

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EXPLORING AND BRIDGING NEXUS FOR
A SUSTAINABLE FUTURE

Challenges and Opportunities for WEFE Nexus Solutions

Bassel Daher, PhD

Assistant Director for Sustainable Development | Texas A&M Energy Institute

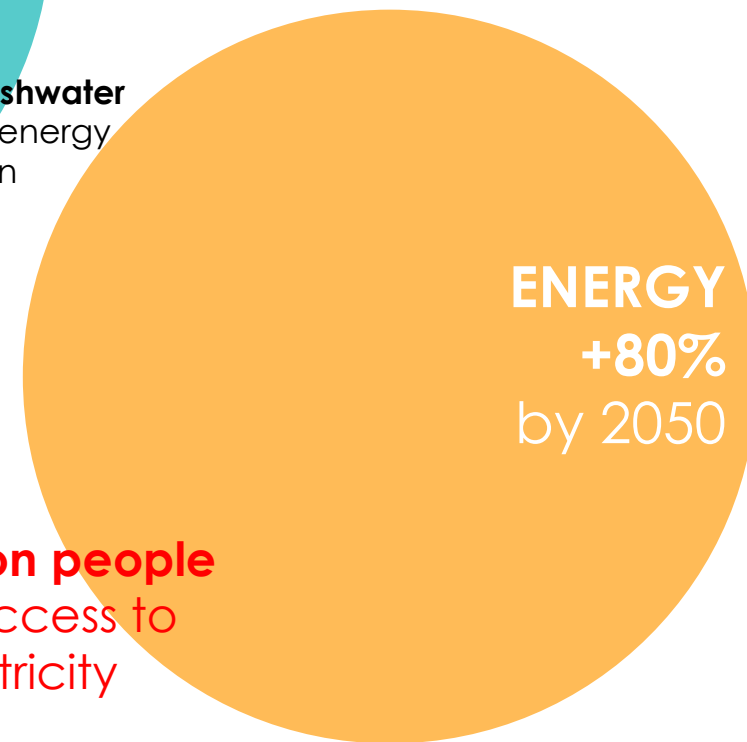
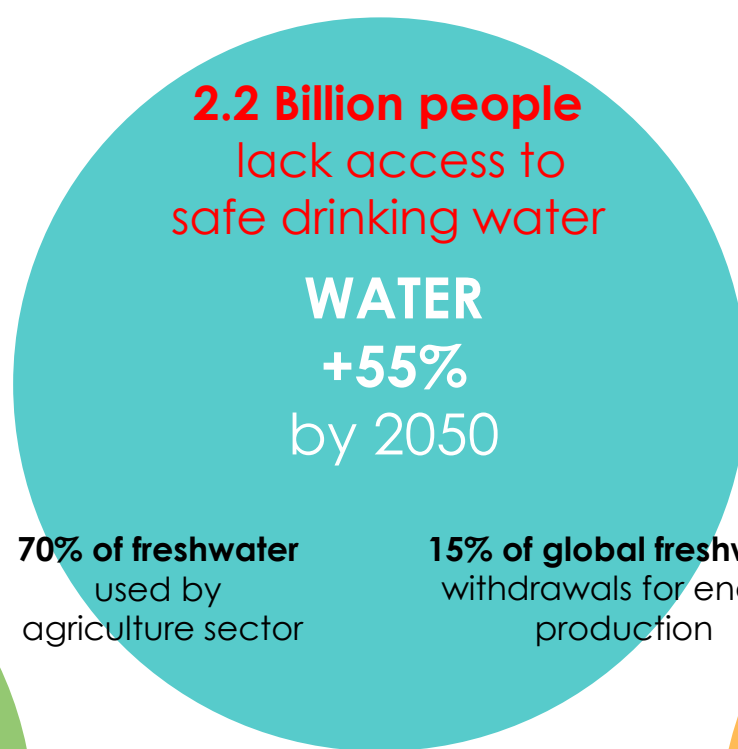
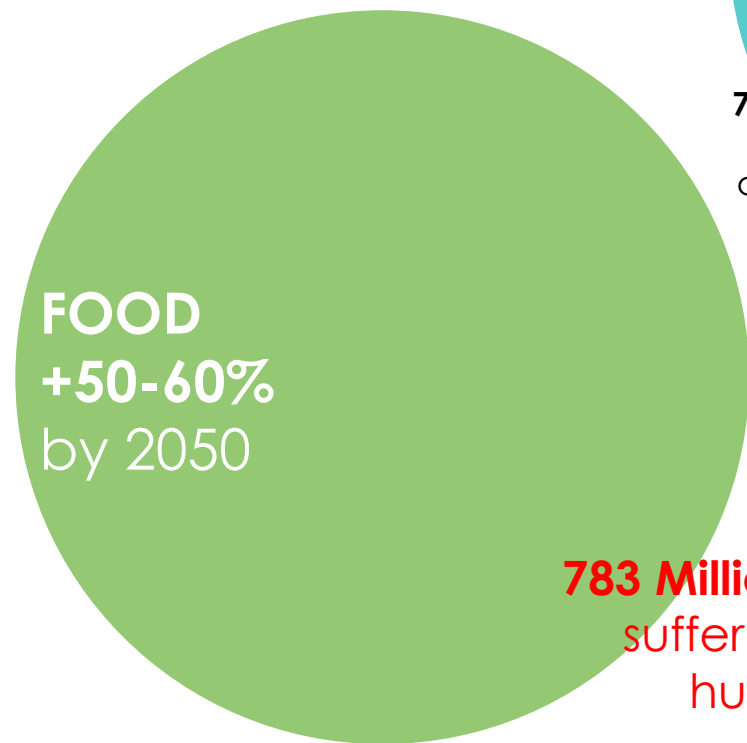
Research Fellow | Institute for Science, Technology, and Public Policy

Adjunct Assistant Professor | Department of Biological and Agricultural Engineering

Texas A&M University



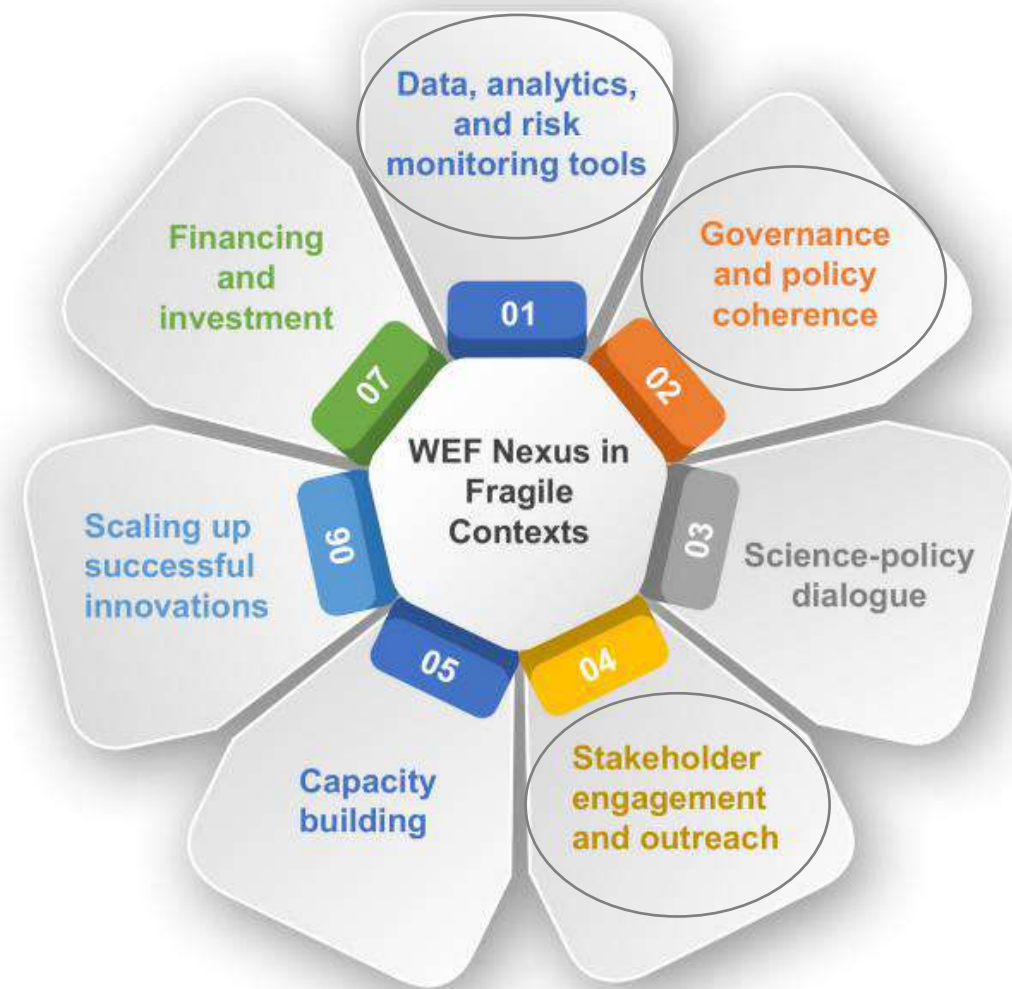
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30% of world energy
consumed by food sector

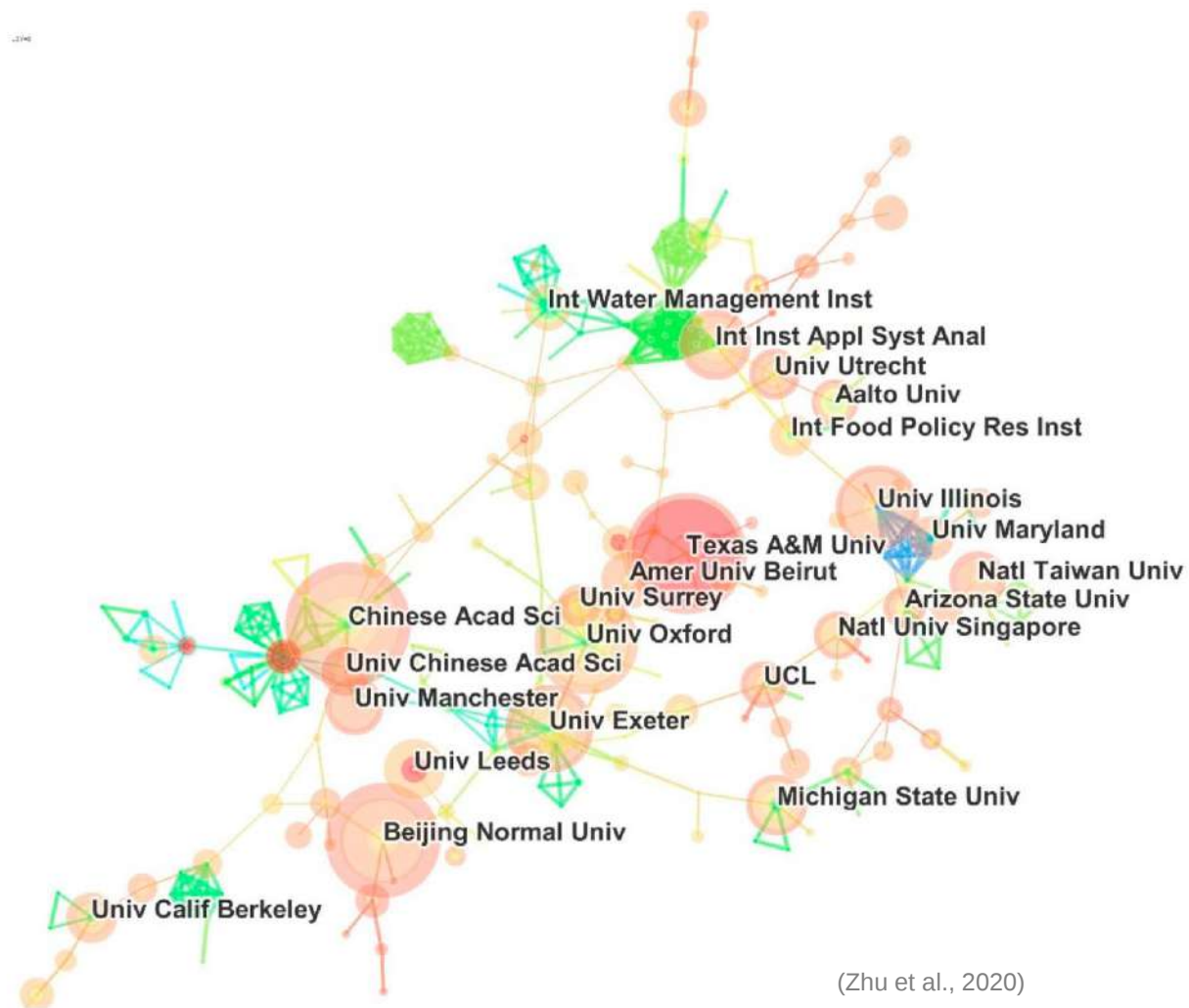
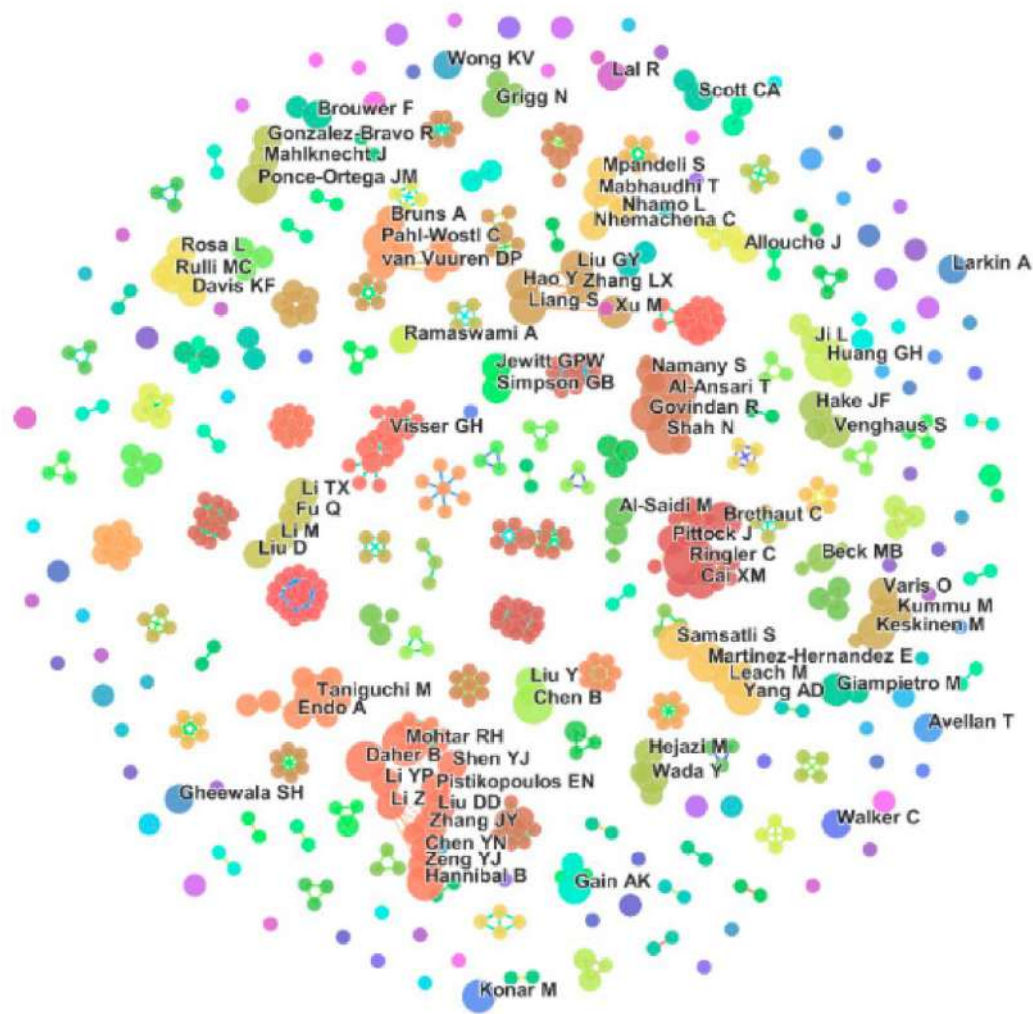
(IRENA 2015; Daher and Mohtar, 2022)

Seven Strategic Action Areas

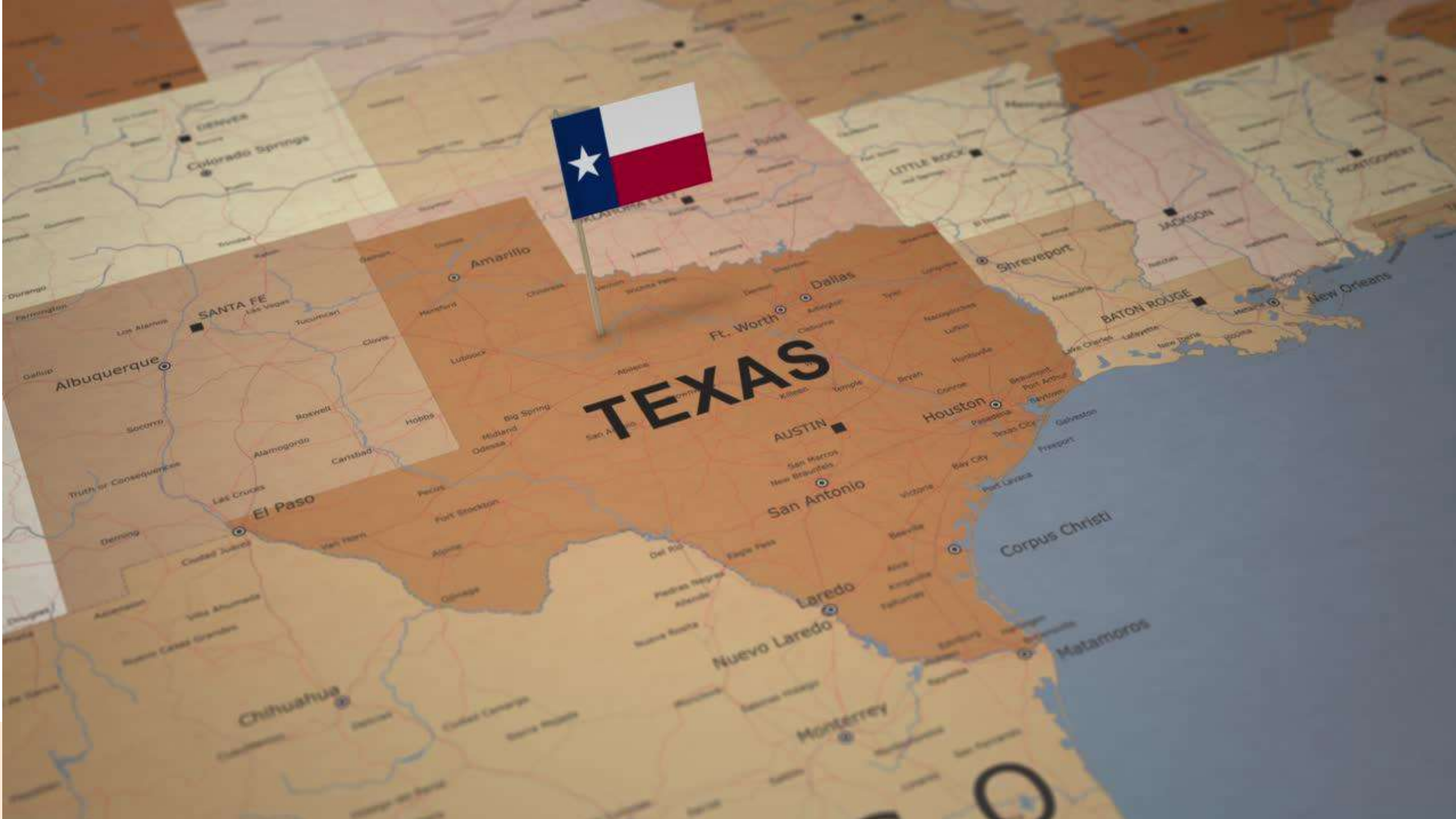


(Al-Zu'bi, M.; Daher, B.; Brouziyne, Y.; Laamrani, et al., 2023)

WEFE Nexus Research Networks



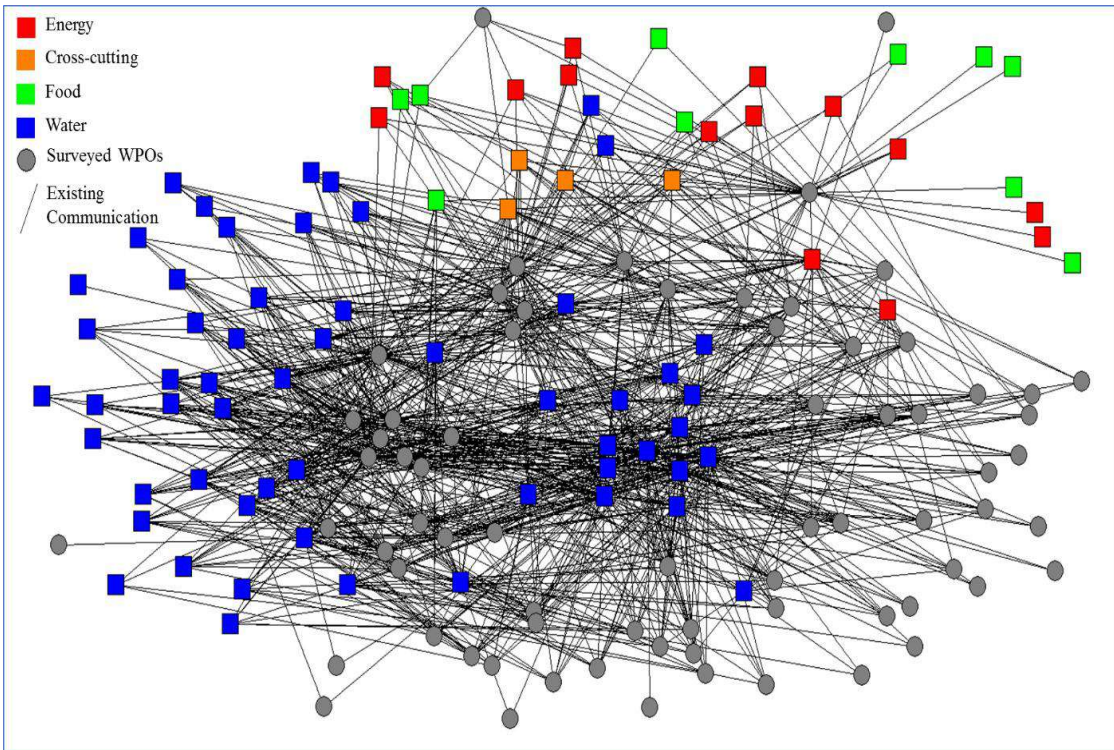
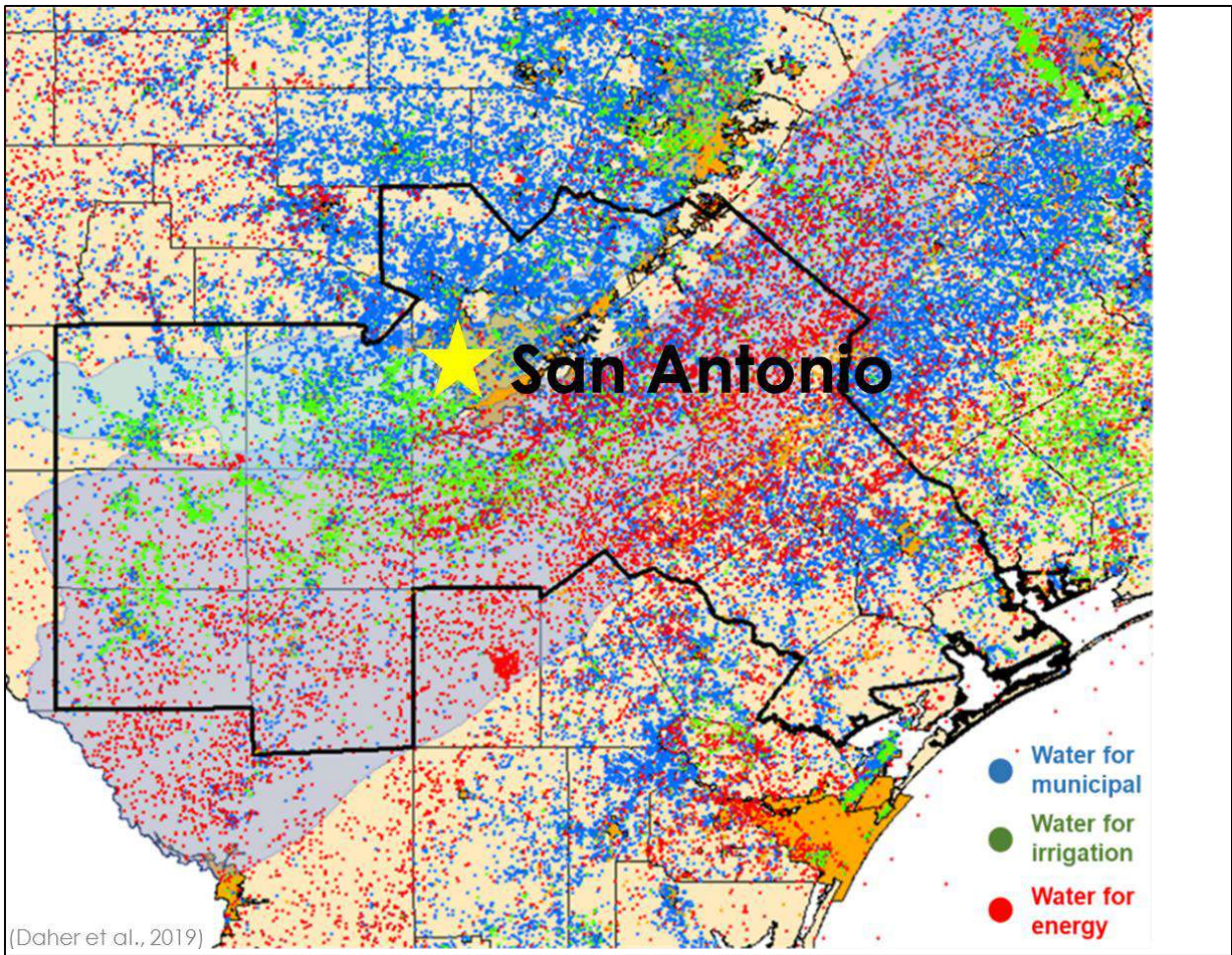
(Zhu et al., 2020)







Water-Energy-Food Nexus Hotspot

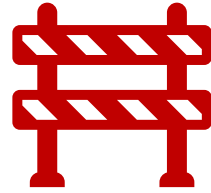


90% No communication

10% some level of communication

Stakeholder Engagement Workshop

Barriers to Communication



Stakeholder Engagement Meeting in
San Antonio, TX

1. **Legal and procedural barriers:** Institutional mandates and lack of coordination mechanisms.
2. **Financial:** who will pay for the time and effort involved in pursuing increased communication?
3. **Uniformity of Language** (units, abbreviations, syntax and context of problems and solutions).
4. **Planning Horizons** differ for water, energy, and food (10 to 50 years) causing ideological differences and creating barriers.
5. **Different values systems** differ across sectors and organizations.
6. **Competition** between local, regional, global organizations and across industries leads to issues of confidentiality, restricted data.
7. **Self-interest versus collective goals** - Silo mentality
8. **Lack of common goals** and collaborative projects

WEFE Nexus is Jordan

Jordan ▾ in 2023 ▾

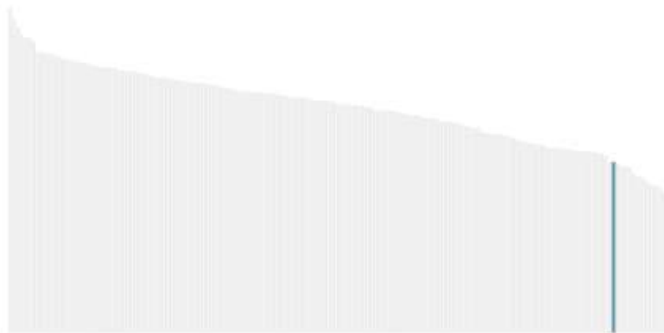
The Water-Energy-Food (WEF) Nexus Index is a composite indicator that aggregates 21 globally available indicators. The WEF Nexus Index value for Jordan is **42.7**, placing the nation in the **152nd** position for the countries assessed. Jordan has a value of **49.6** for the Water pillar, **36.1** for the Energy pillar and **42.5** for the Food pillar.



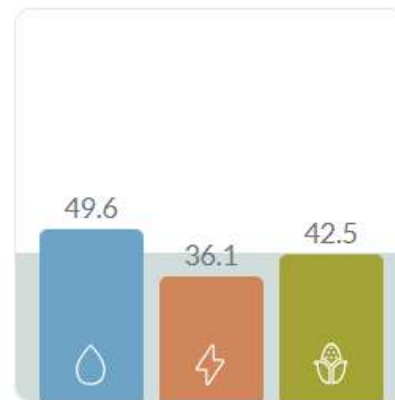
WEF Nexus Index

42.7

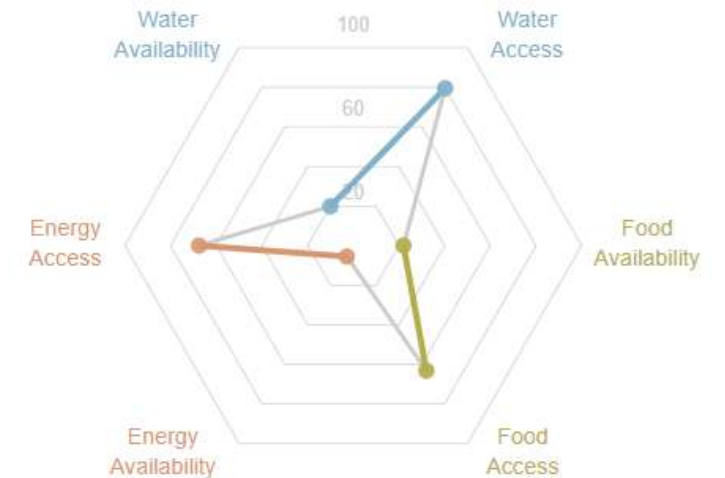
152nd world rank in 2023
vs 149th in 2022



The Index includes three pillars



Each pillar includes two sub-pillars



Economic Modernization Vision



Economic Modernisation Vision
Unleashing potential to build the future



Executive Summary Water

1 Sector Facts (2021)



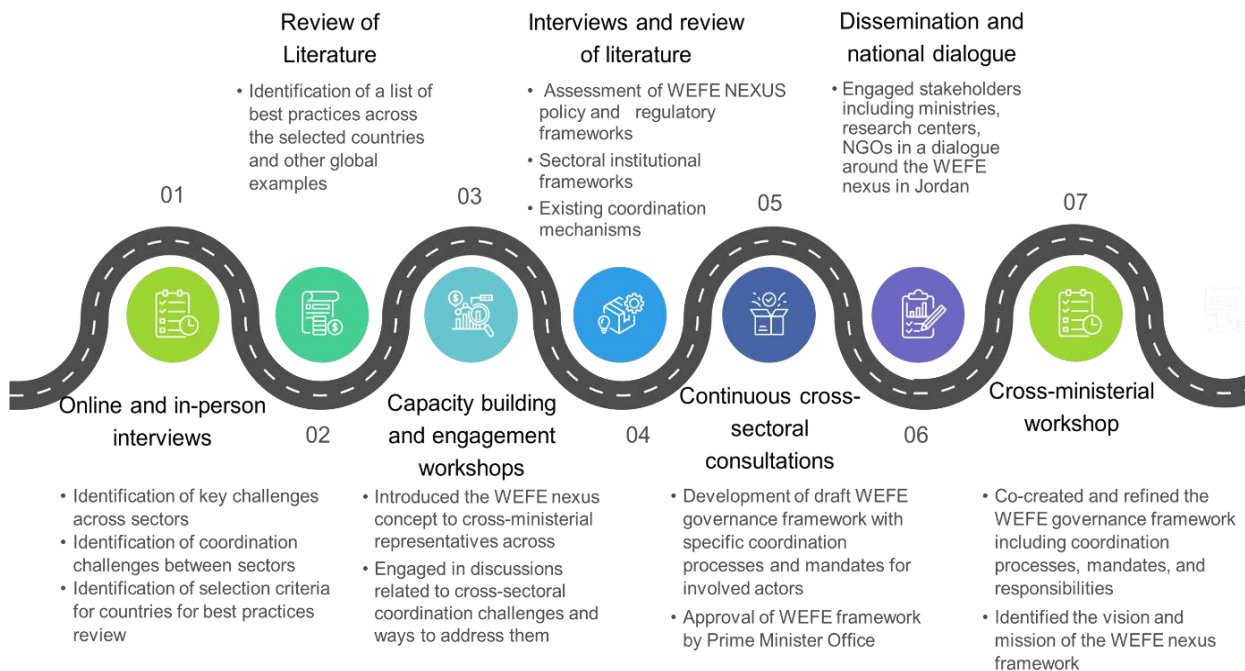
4 Proposed Initiatives

- Reduce NRW* by 2% annually.
- Launch national desalination projects.
- Provide opportunities for private sector investments.
- Improve efficiency of energy use in the water sector, increase the use of renewable energy sources, and implement water dam pumped energy storage projects.
- Improve water efficiency and financial self-sustainability.
- Upgrade water supply/demand management monitoring and control.
- Launch water conservation awareness program.
- Establish climate resilience and sustainable water use.
- Utilize technological solutions for water sustainability program
- Launch National Innovation Center.
- Proper implementation and enforcement of water laws and regulations.
- Establish Nexus Council (Water, Agriculture, Energy and Environment).

* Non-Revenue Water

Development of a Water, Energy, Food and Environment (WEFE) Nexus in Jordan

Overall project Methodology



TEAM

- **Nadejda Komendantova** (*International Institute for Applied Systems Analysis*)
- **Ahmed Al Salaymeh** (*University of Jordan*)
- **Bassel Daher** (*Texas A&M Energy Institute*)
- **Eyad Batarseh** (*Scientific Sustainable Vision for Engineering and Environment*)
- **Aleksandr Martusevich** (*International Institute for Applied Systems Analysis*)
- **Hani Muhsen** (*German Jordanian University*)

Interviewed Stakeholders

Consulted Stakeholders

- Prime Minister's Office
- Ministry of Energy and Mineral Resources
- Ministry of Water and Irrigation
- Ministry of Environment
- Ministry of Finance
- Ministry of Planning and International Cooperation
- Water Authority of Jordan
- Jordan Valley Authority
- National Electric Power Company (NEPCO)
- Energy & Minerals Regulatory Commission
- National Center for Security and Crisis Management
- Member of Energy and Mineral Resources Committee/ The Jordanian Parliament
- The Higher Council for Science and Technology, The National Center for Research and Development
- Jordan Society for Scientific Research, Entrepreneurship, and Creativity
- EDAMA Association
- GIZ-Jordan
- German Development Bank
- World Bank
- EU Delegation to Jordan
- Friedrich-Ebert-Stiftung Jordan & Iraq



30+ Zoom & In-person interviews in August-September 2022

Questions on topics including:

- *Sectoral challenges*
- *Barriers for cross-sector cooperation*
- *Success stories*
- *Suggestions for improved governance structures and mechanisms*
- *Decision making challenges*



Nexus Regional Dialogues Programme & Energy Efficient Water Sector Project



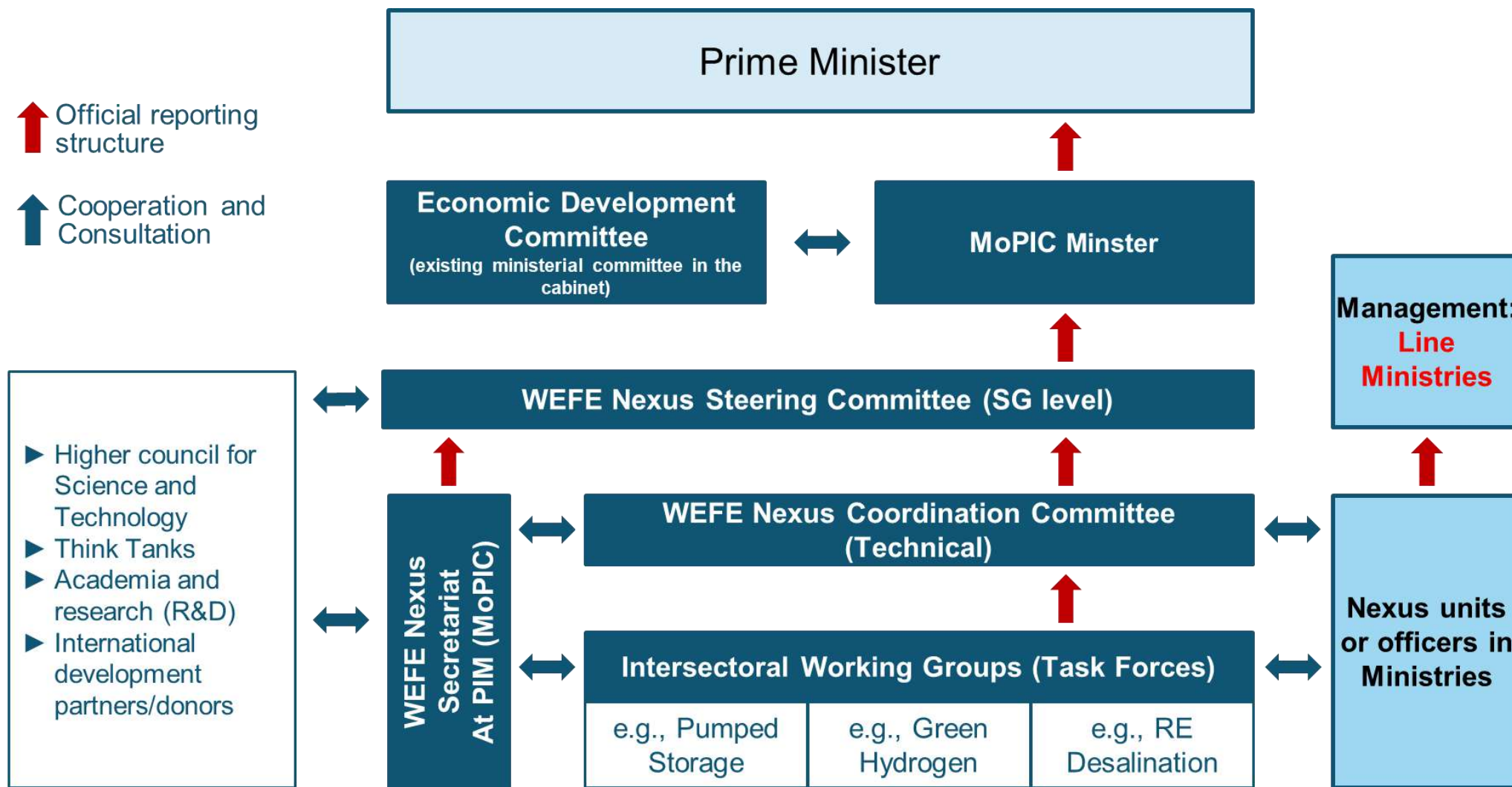
These projects are part of the PRIMA programme supported by the European Union.

Key Institutional and Governance Challenges

1. Different sectors operate with distinct **strategic interests**, **legal frameworks**, and governance **structures**.
2. Lack of a **common long-term vision** leads to **siloed planning**.
3. Frequent **leadership changes** and **shifting high-level guidance** create reluctance to drive change.
4. **Inefficiencies within the public sector** hinder effective decision-making and implementation.
5. **Limited capacity** among **local partners**, as new technologies require technical expertise for operation and maintenance
6. **Weak organizational structures** and **insufficient capacity** to lead coordination efforts.
7. **Absence of technical personnel** to follow up on high-level agreements and ensure coordination.
8. Challenge in identifying **who will be leading this coordination** and **which ministries should be involved**

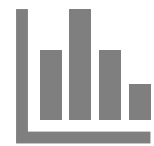
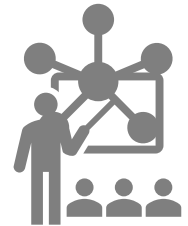
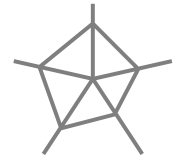


Approved WEFE Nexus Governance Framework



Gaps and Next Steps

1. **Co-identify common performance indicators** across sectors to facilitate alignment of strategies and enhance coordination.
2. **Develop tools and analytics** to evaluate the impact, synergies, and trade-offs of sectoral plans on these Key Performance Indicators (KPIs) will be crucial for informed decision-making.
3. Prioritize **capacity building in systems thinking** will foster a shared understanding of WEF E nexus challenges and opportunities among cross-sectoral stakeholders.
4. Implement **mechanisms for data exchange and sharing** will enable the synthesis of existing data, facilitating varied analyses and quantifying the impact of different strategies on collective indicators.



WEFE Nexus Analytics

Scenarios

Food

Choice of type and amount of crops produced

Water

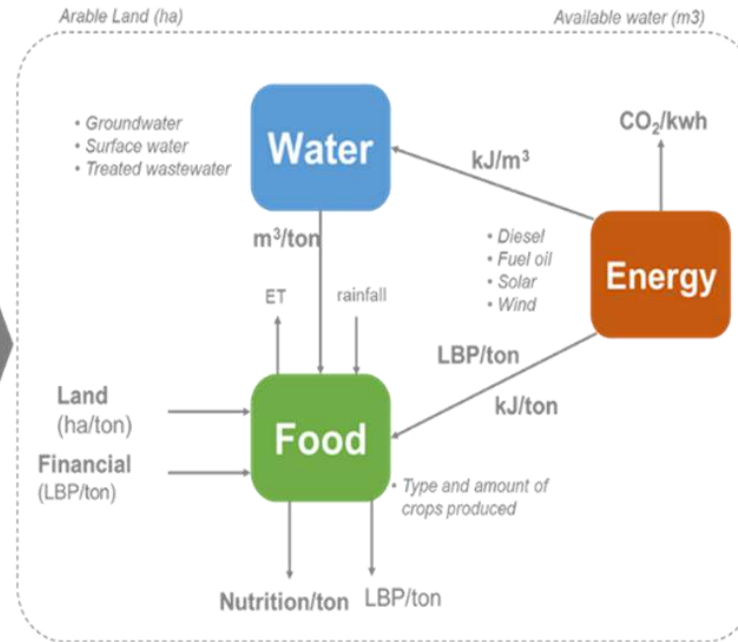
Groundwater
Surface water
Treated wastewater

Energy

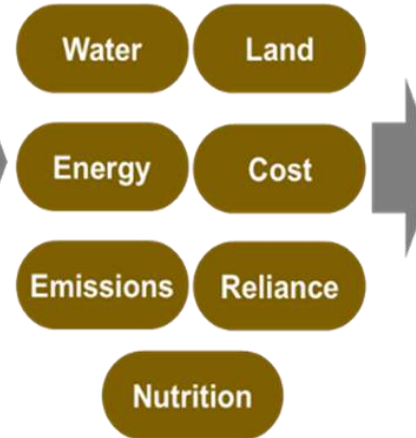
Diesel
Gasoline
Solar
Wind



The Resource Management Strategy Guiding Tool

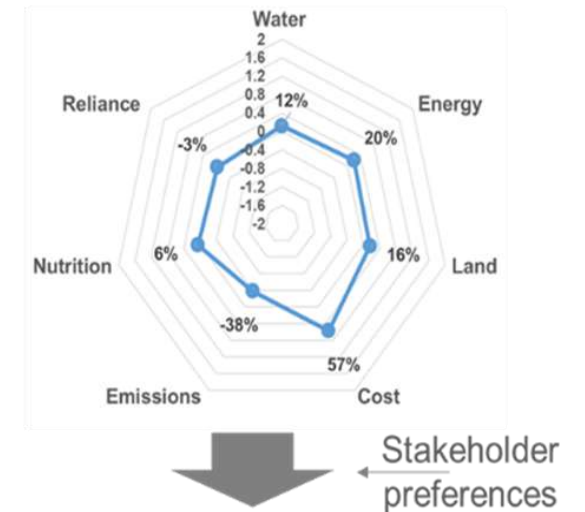


Scenario Outputs

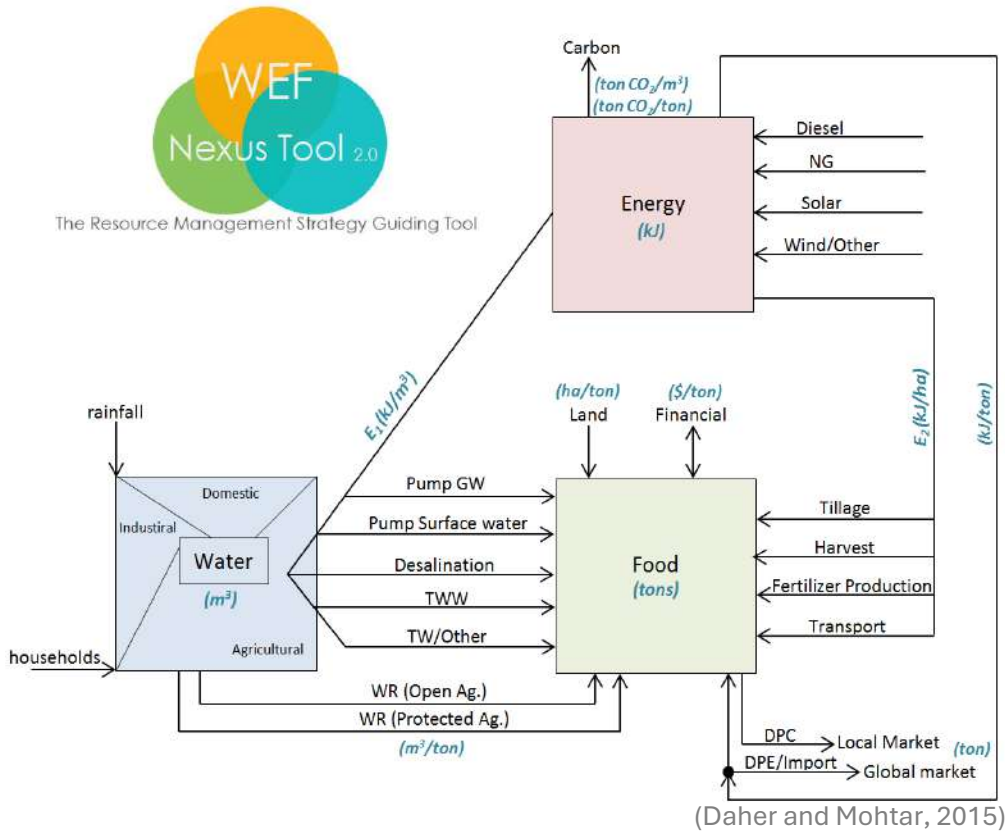


(Daher and Mohtar, 2015;
Daher et al, 2022)

Trade-off Evaluation



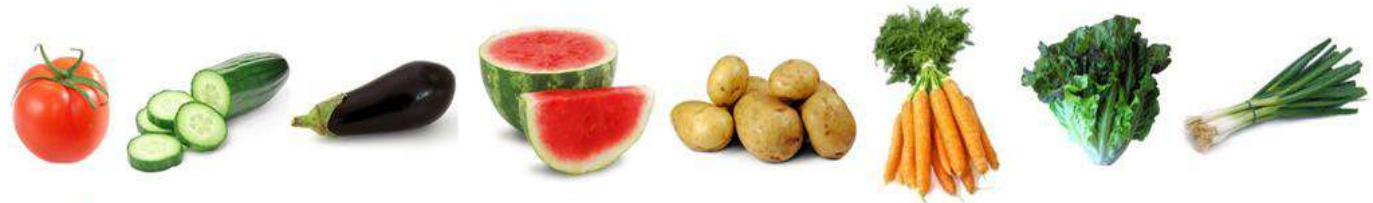
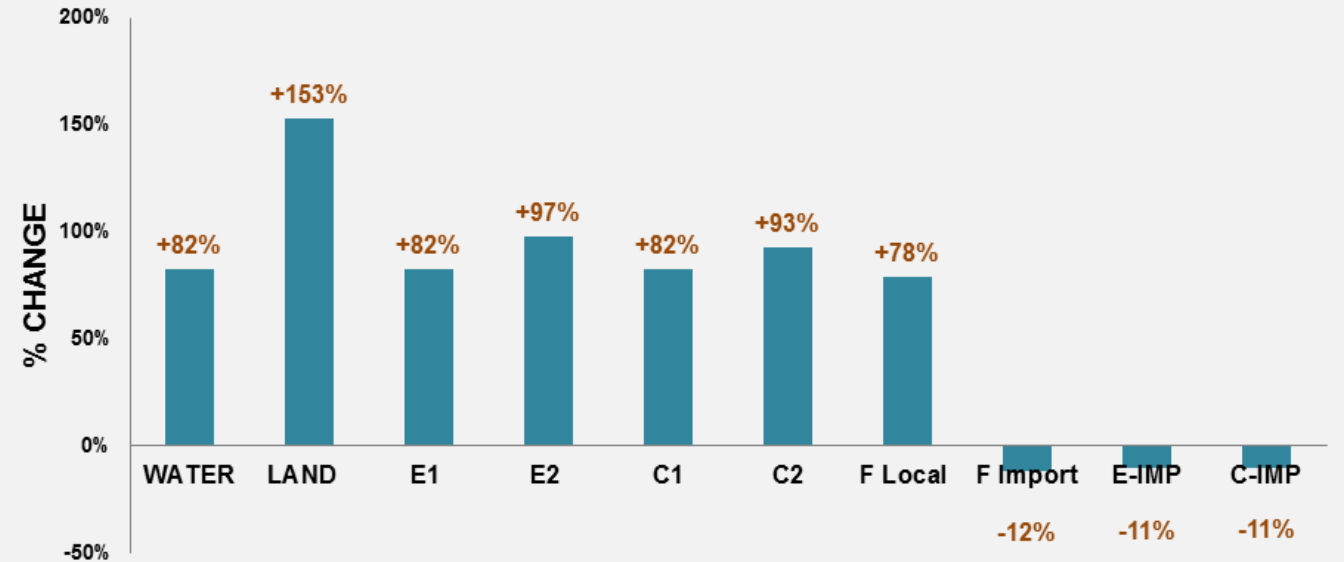
Qatar



- Shift in narrative from full self-sufficiency to trade-offs
- Develop robust trade strategies for primary food needs; identify countries of low risk; diversify import sources
- High water, energy, land, \$ costs = higher security

Hypothetical Scenario

Percentage change for resources as a result of 10% increase in self-sufficiency per product





Scenario A: Nutrition-centric

Increase beans (green, broad, dry), lentils, chickpeas and peas (dry, green) to 100% SS

- Water: 80% aroundwater, 20%

Rank the decisions you are most likely to do on your farm.

1

Use alternative energy sources

in an effort to

1

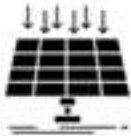
improve profit

2

save water

3

reduce emissions



2

Grow different crops

in an effort to

1

improve profit

2

save energy

3

save land

4

save water

5

reduce emissions

6

improve nutritional value



3

Use alternative irrigation sources

in an effort to

1

improve profit

2

save energy

3

save underground water

4

reduce emissions



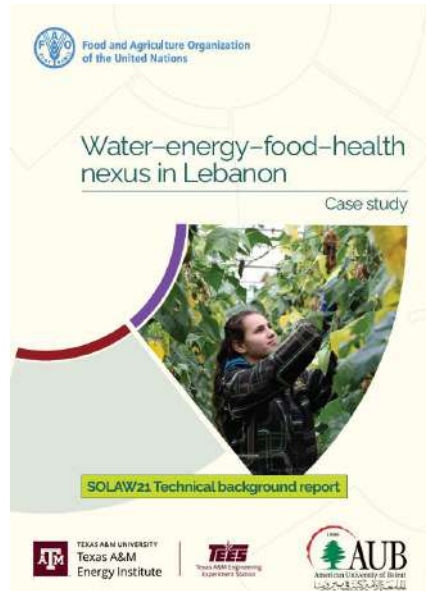
- Energy-Water: 100% Diesel
- Energy-Food: 70% Diesel, 30% Gasoline



(Daher et al, 2022)



Lebanon



- Investing in locally producing Lebanon's needs of ***broad beans, lentils, chickpeas, and peas***, results in **cost savings, increased nutritional value** in the locally produced basket, and **reduced reliance** on foreign markets.
- This comes at additional **water, energy, land** and **carbon** footprints which need to be accounted for.
- Given the uncertainty of future **currency conversion** rates, it becomes more critical to identify a strategic food basket that could be produced locally to reduce reliance on foreign markets.
- This analysis can support **national tradeoff evaluation** toward answering major questions within the food and agricultural system related to food self-sufficiency and economic development.
- These analytics could play a role in engaging multi-stakeholders and catalyzing **cross-sectoral dialogue** around tradeoffs and future pathways and development strategies.
- The case study could be adapted and **replicated** in other countries in the MENA Region.



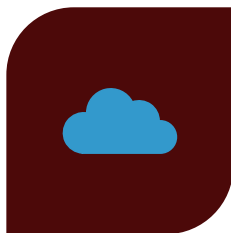
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Existing Challenges for WEF Nexus Assessments



DATA AVAILABILITY AND ACCESSIBILITY

Lack of comprehensive, reliable data



DATA INTEGRATION

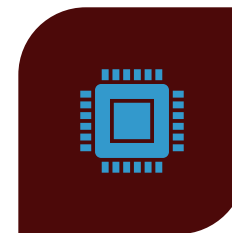
Varying formats, resolutions, temporal scales



DATA QUALITY AND ACCURACY

Inconsistent, outdated, or poor-quality data can undermine the reliability;

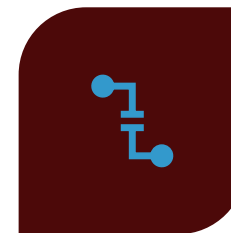
Particularly problematic when using proxies or extrapolating data from incomplete datasets



DATA SHARING AND GOVERNANCE

Institutional barriers to data sharing

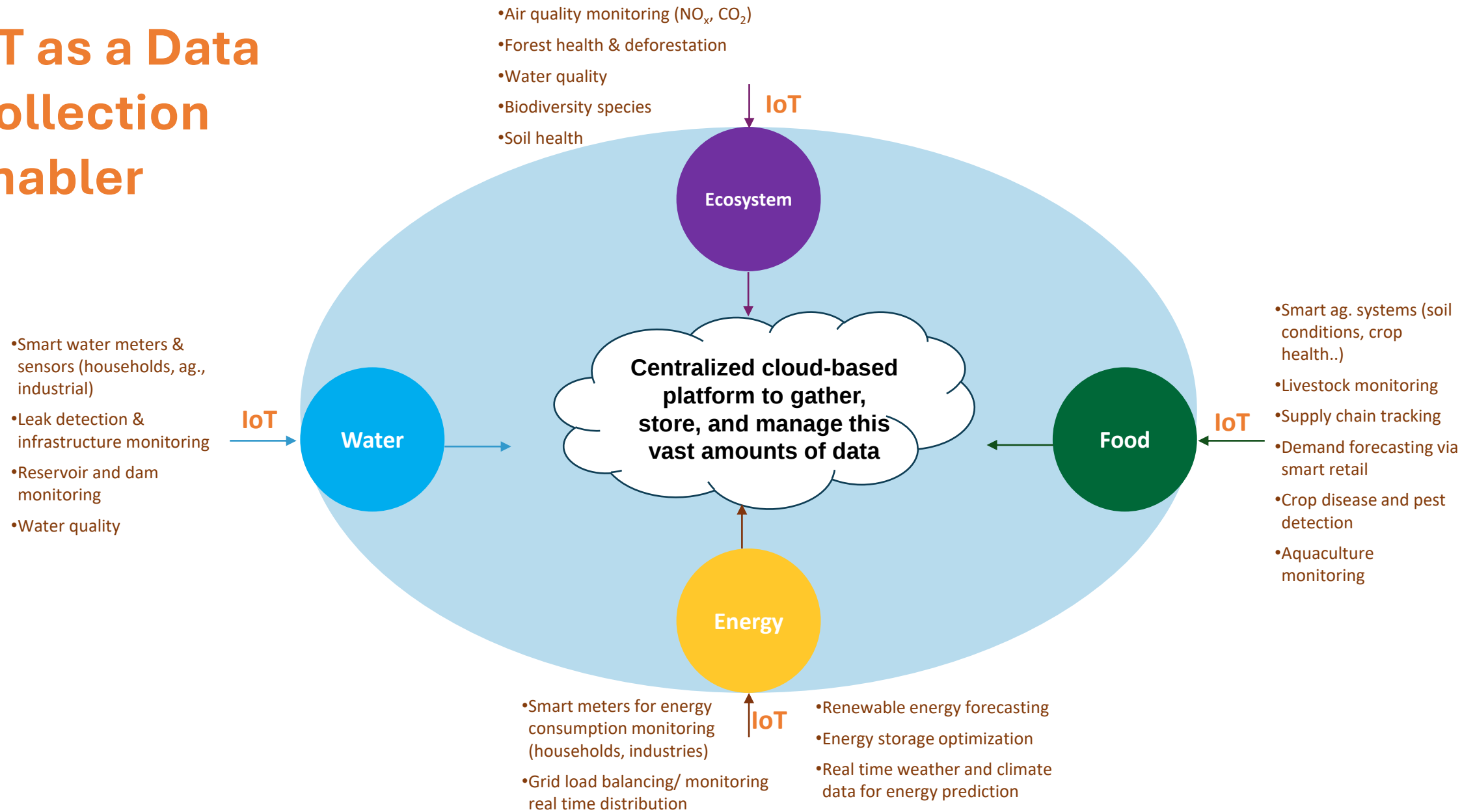
Data ownership can limit access to necessary datasets across sectors



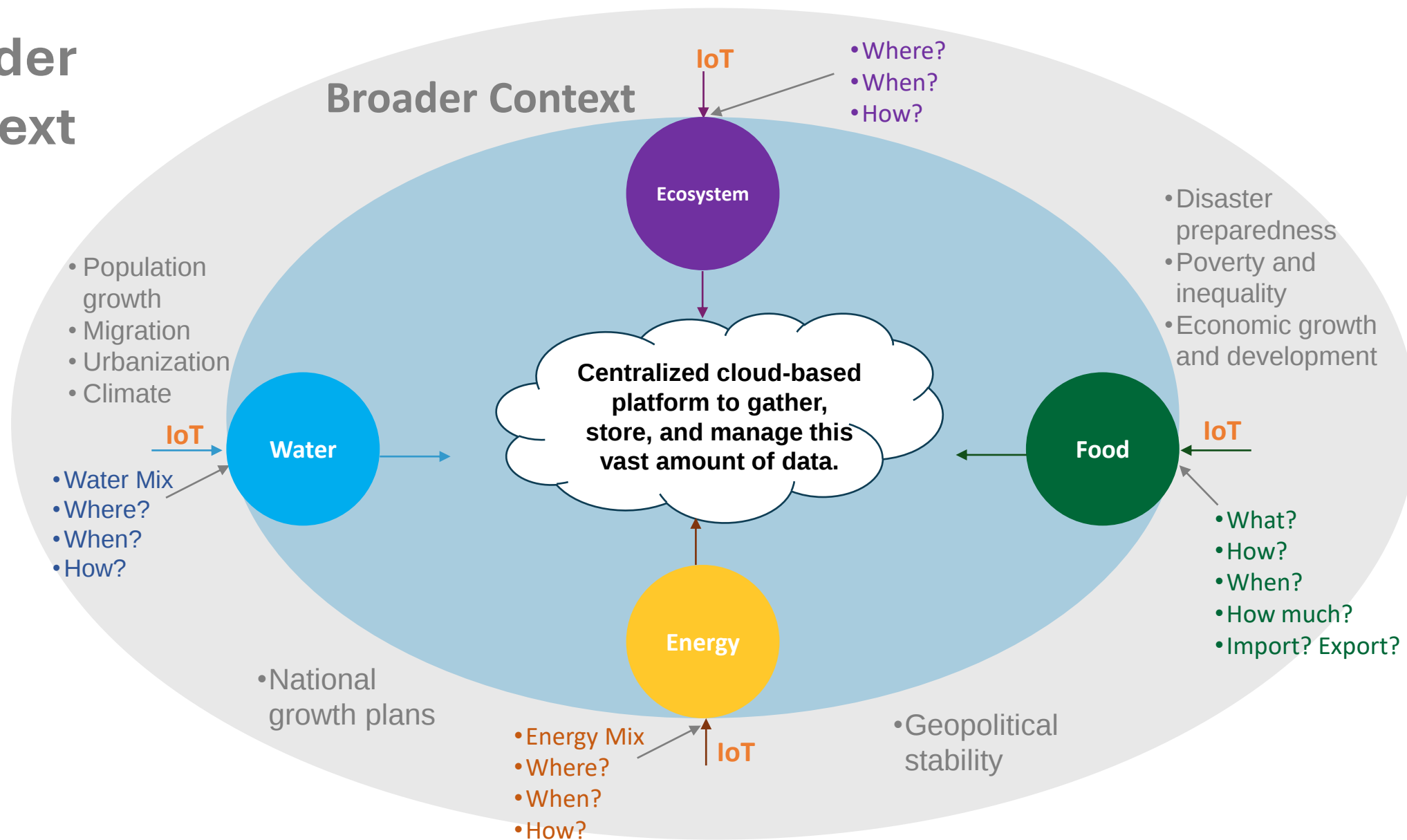
DISCONNECT BETWEEN DATA USERS AND DATA COLLECTION

Disconnect between data collected and data needed for decision making

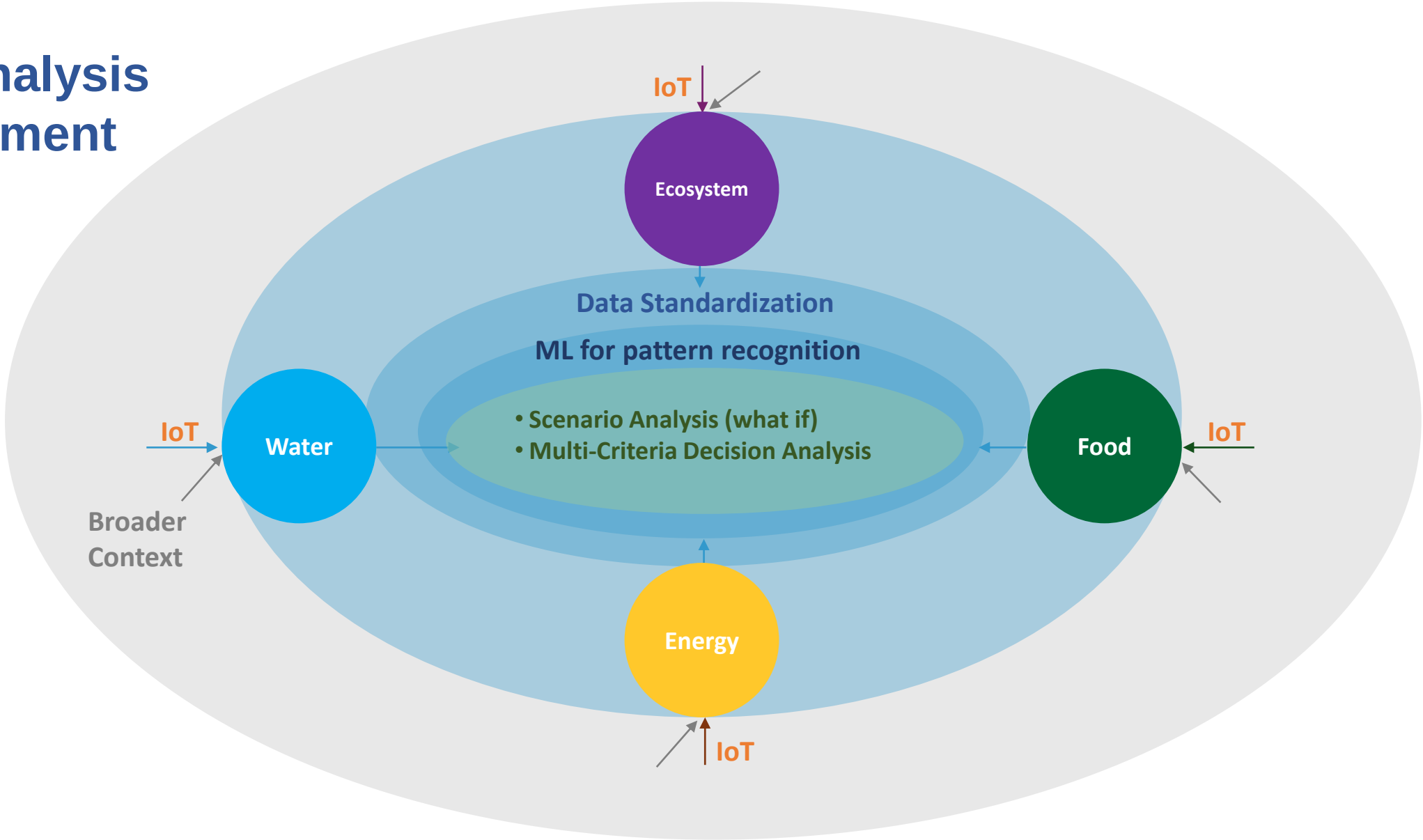
IoT as a Data Collection Enabler



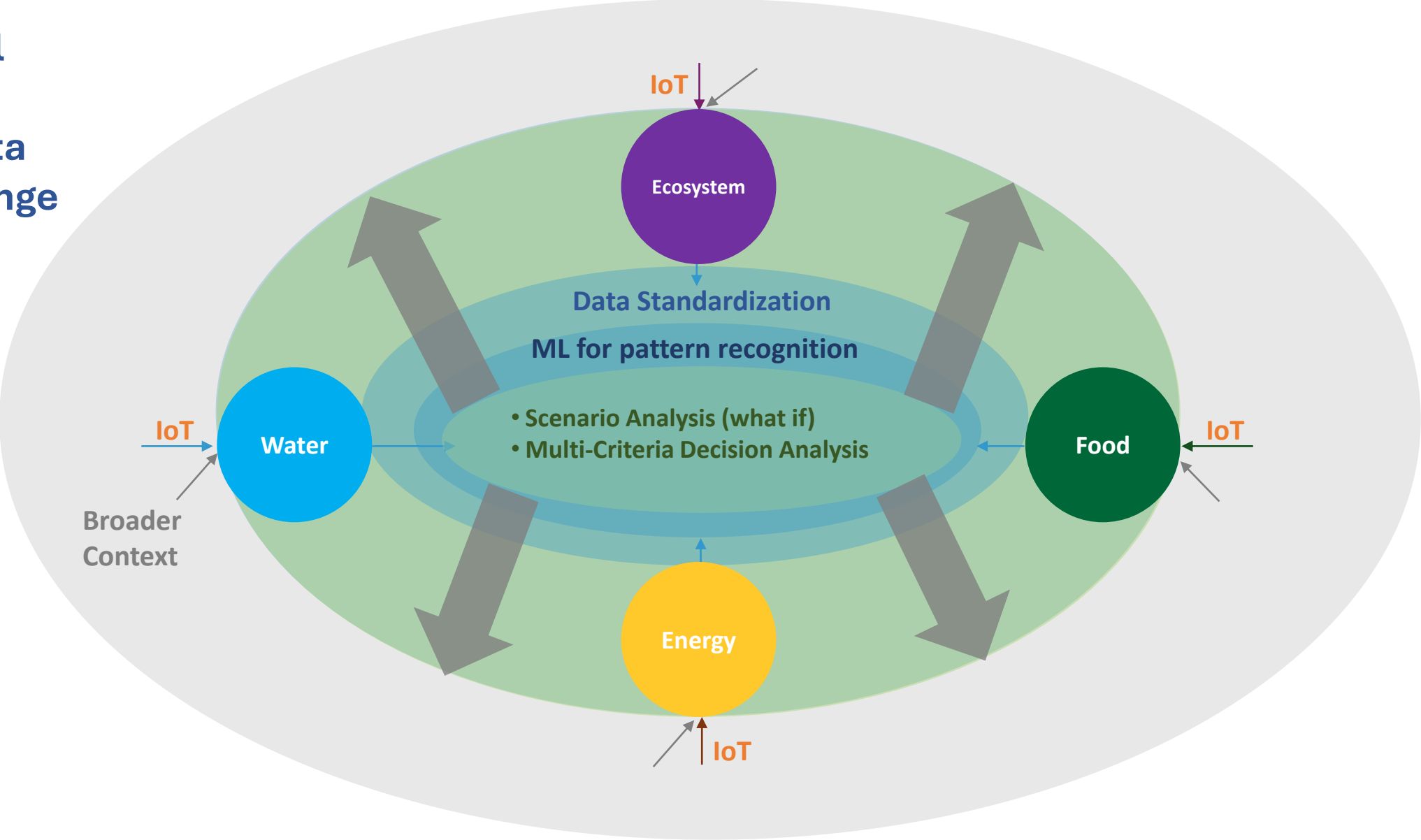
Broader Context



Scenario Analysis and Assessment



Cross-sectoral
analysis while
addressing data
sharing challenge



Remaining Considerations



Challenges in
**harmonizing multi-
sectoral data** for AI
analysis



Lack of **technical
expertise in AI** and
**domain-specific
knowledge in WEFE
systems**



**High computational
requirements** and
**infrastructure
limitations**



Data privacy and
governance issues,
especially in politically
sensitive regions



**Resistance to adoption
of AI solutions** in
traditional governance &
resource management
frameworks



IMAGINE
“Harnessing AI and IoT
for Enhanced WEFE Nexus Security:
Challenges, Opportunities, and Future Directions in Jordan”
(META AI)



IMAGINE
 “WEFE NEXUS in JORDAN”
 (META AI)





International
migrants^a

281 million

international migrants globally in 2020,
or 3.6 per cent of the world's population



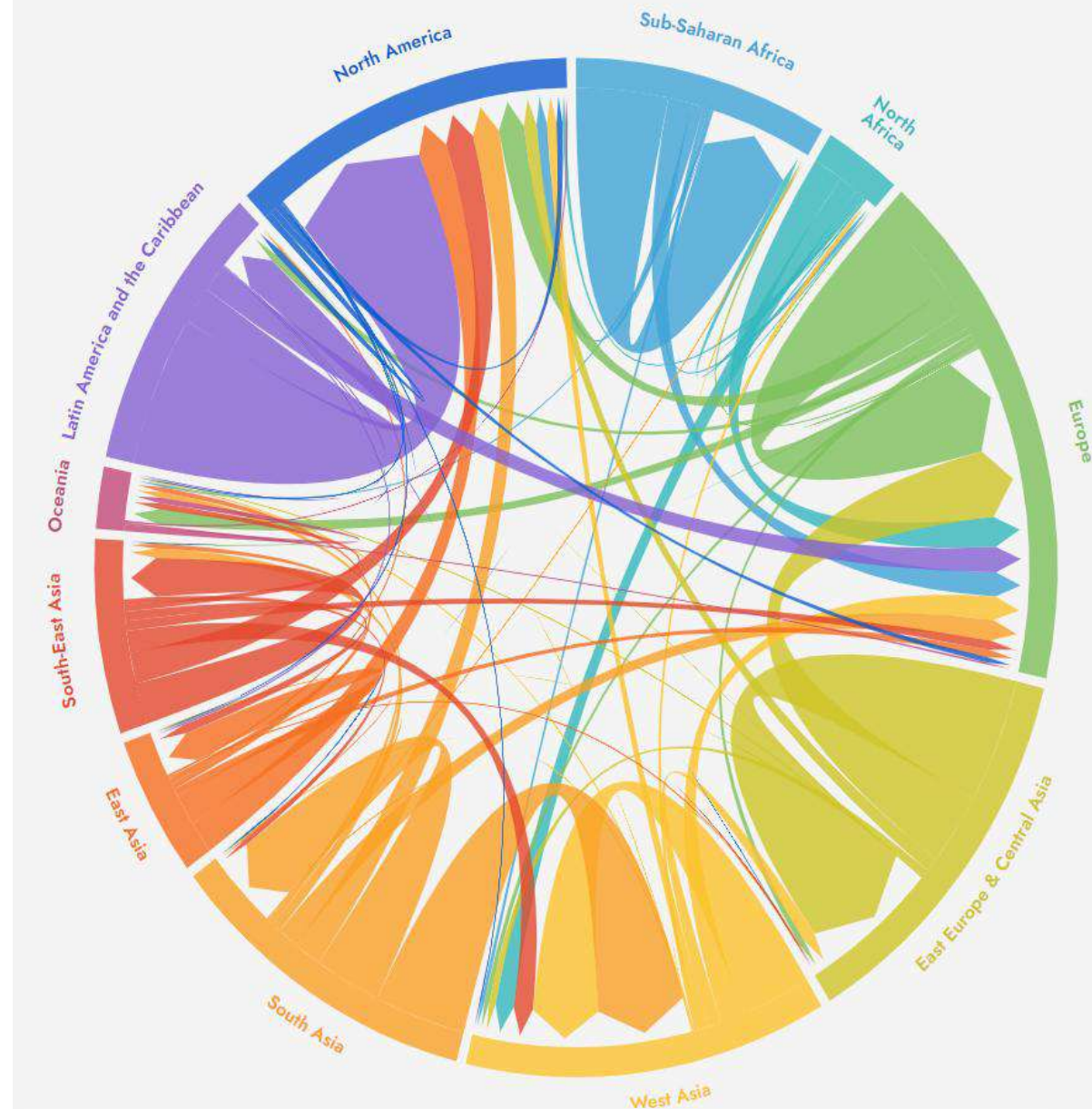
Displaced
persons^{e,f}

117 million

people were living in displacement globally
at the end of 2022 (includes refugees,
asylum-seekers, IDPs and others)



WORLD MIGRATION
REPORT 2024



Abel, G.J., Cohen, J.E. (2019). [Bilateral international migration flow estimates for 200 countries](#). *Sci Data* **6** 82

BUILDING NEXUS RESILIENCE: ADDRESSING MIGRATION AND CONFLICTS IN WATER-ENERGY-FOOD SYSTEMS

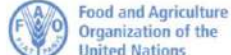
WEBINAR SERIES

Webinar #1

Webinar #2

Webinar #3

Conference Session



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**SURE
NEXUS**



PRIMA
PARTNERSHIP FOR RESEARCH AND INNOVATION
IN THE MEDITERRANEAN AREA



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