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Food for Trade or Food for National Food Security: A Dilemma for Drylands

By Rabi Mohtar

Summary

Addressing the increasing demands for water, energy, and food requires a coherent methodology to ensure that societies have access to them and that conflict over them is avoided. For example, agriculture and food production require water and energy; energy production also requires water and, in some instances, agricultural products. Water distribution and treatment can be very energy intensive. Therefore, the benefits of approaching the Water-Energy-Food (WEF) nexus in an integrated way are gaining popularity. The public sector, the private sector, civil society, combined with the geopolitical and socio-economic-climatic environment are all interactors that form a complex web in the management of these fundamental resources. The MENA region relies heavily on international trade to ensure national food and nutrition securities and, with world crises and changing global landscapes, this has created a concern among nations as to whether it is sustainable or focusing on creating greater food self-sufficiency is a better alternative. This policy brief illustrates the use of computer decision support systems (DSS) to aid in the understanding of the WEF nexus with a particular focus on evaluating food production for trade or for self-sufficiency.

The Interconnection of Water, Energy, and Food in a changing world

Water, energy, and food securities are interlinked and form a complex system with a web of interactors. We are still at the early stages of understanding these complexities (Mohtar et al., 2020). We need a system that integrates the quantification of these resources, which also helps us move beyond analytics into sustainable and actionable solutions and actionable knowledge (Jones et al., 2021).

In the agriculture system community, the interdependency of water and food production is an obvious example. Over 70% of the freshwater in the world goes into food production (World Economic Forum, 2011), which makes communities extremely vulnerable as less water is available for other sectors. Additionally, food systems become unstable with water competition for industrial, energy production, and other uses (Beekwa et al., 2021).

Ideally, we need to reduce these interdependencies, which will allow for more resilient communities, as it will promote ecosystem and human health well-being. As a simple example, a less interdependent food system will allow for sustainable food production during water scarcity, be it by using more efficient irrigation techniques or by using recycled/treated water. That's what a system approach is intended for, and it is essential for achieving the Sustainable Development Goals (SDGs) as highlighted by the United Nations (UN, 2021). The choice of technologies to create resiliency in the nexus should therefore consider not only the cost and feasibility but should be assessed as a function of 6 different aspects (Mohtar, 2016):

- primary resource requirements and needs of water, energy, and food;
- economic and financial requirements;
- environmental and ecological impacts;
- human capacity requirements and needs to develop, operate and maintain the technology of choice;
- technical feasibility and requirements and robustness of the technology of choice to local conditions;
- social and cultural outlook of the technology of choice

Computer-based decision support systems like the WEF Tool 2.0 (Daher and Mohtar, 2015) is a clear example of how these tools can greatly aid in the process of decision making, taking into consideration a systems approach.

Multi-sectoral and inclusive discussions are imperative when considering interdependencies and tradeoffs of resources. To meet the growing and competing demand for resources, fundamental reforms in the water and agricultural sectors must increase integrated decision-making processes at national and regional levels. Such reform must include multi-stakeholders and achieve synergies to adequately address trade-offs among agriculture, water, energy, and land (while also safeguarding ecosystems and creating resilience to changing politics and climate).

This policy brief shed light on the Water-Food Nexus and present policy implications towards creating a healthy balance between food production for domestic consumption and food for trade. Such trade will contribute to the local GDP growth and provide communities with needed income in foreign currency.

Food production: Trade or self-sufficiency?

The agricultural sector provides food security for local communities and livelihoods with social, cultural, and environmental impacts. The regional and political realms are part of the agricultural sector planning and implications. According to the World Bank, close to 30% of global employment goes to agriculture (World Bank, 2021).

The Middle East relies heavily on food imports making the region most vulnerable to regional and global crises. For example, Morocco is projected to import more food than before, as production has decreased by 50% (primarily due to drought and climate variability) (Karaspan, 2020). Conflict and economic crises in countries like Lebanon, Syria, and Yemen have pushed people into poverty as it limits access to food and nutrition and drive food prices up.

In the Middle East, can food trade facilitate food security or is it a risk to the domestic food basket? On the one hand, trade can diversify nutritional access diversity (especially in countries with limited land and water resources) and liberalize trade to bring growth to the national economy. On the other hand, 's's there's a big push to encourage local self-sufficiency to secure food production for the entire population and facilitate social gains (such as employment, local diets, etc.). ' 'There's also the argument that uneven trade liberalization across different countries is a risk. The hybrid viewpoint does not call for an end to all food trade, it argues that national- local food systems should be prioritized over

food trade within the mainstream industrial food system (Clapp, J., 2015). This policy brief presents tools that will guide this hybrid approach.

One study estimates that some 16 percent of the ' ' world's population relies on international trade to meet their food needs and projects that the number of people who rely on imported food could rise to 51 percent of the ' 'world's population in 2050. By 2050, up to 1.3 Billion people in low-income economies, mainly in Africa, risk food insecurity, unless there is an increase in productivity, cropland is expanded, and import food from other countries (Fader et al., 2013). This might result from trade policies and be affected by limited resources, climate change, and cost-effectiveness.

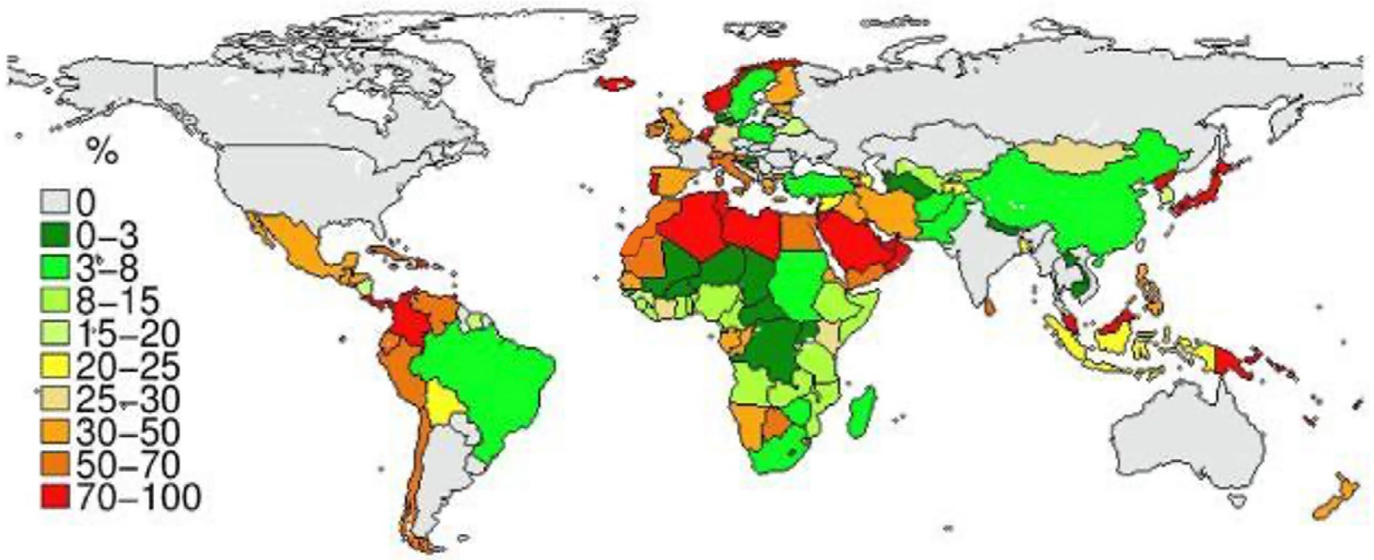

Figure 1. Percentage of the population dependent on external water and land resources in 2000 considering the 'importers' current water and land productivities, present land-use patterns, and international trade flows averaged for 1998–2002 after COMTRADE (Fader et al. 2013).

Hence, is greater food self-sufficiency feasible for countries in the MENA and other drylands? Dealing with fast-changing externalities and crises requires more indicators and data to make informed decisions and answer questions such as:

1. Can the country sustainably produce its Mediterranean food basket from economic, environmental & social well-being perspectives?
2. How to introduce nutrition & food quality to the WEF security framework, considering that nutrition and diet are central to human health?
3. What are the trade-offs between water productivity, energy, and water efficiency, and nutritional value of food?
4. What are the trade-offs and how to balance food production for local food demand and food for trade and the national economy?
5. What are land use and crop allocation policies needed to meet the national needs for local food security and fresh income to producers?

Help in Sustainable Decision Making

Modeling tools are being developed that allow more informed decision-making for different stakeholders. These tools provide indicators showing the impacts of different scenarios into several sectors necessary for coherent policy analysis. A recent study by the WEF nexus group in partnership with the FAO examined Lebanon, which is enduring one of the most severe economic crises in modern history. The ongoing Covid and currency devaluation has left around 80% of the population below the poverty line. Additionally, population increase, including refugees, have put pressure on local water, land, food, and energy resources (World Bank Group, 2021) (as of 2015, there were around 1,100,000 Syrian refugees) (UNHCR, 2015).

The currency crisis in Lebanon has rendered access to US dollars very hard. It has caused an uncontrolled increase in food prices for imported goods, requiring more local food security and reducing reliance on imports. In 2019, domestic agri-food production satisfied only 20% of ' 'Lebanon's demand (FAO and ESCWA, 2021). The big challenge is reducing the water gap and energy cost demand: approximately 61% of water resources go to agriculture (as 50-80% of agriculture is irrigated). Similarly, energy production has its challenges: 96% of the energy produced uses fossil fuel (which is 100% imported), and only 3% hydropower and 0.35% solar.

In this study, the group looked at how much more resources would it take to increase the production of 3 crops (with high nutritional value in the Mediterranean diet), such as beans, lentils, chickpeas, and peas, from less than 20% to 100% of self-sufficiency. The study showed that to become 100% self-sufficient in producing these crops, an increase of water demand of 12%, energy production of 12.6%, and land use of 16.1% were required. This would result in a reduction of costs (-1.2%), increased nutrition access (by around 6%), and an evident decrease in reliance on imports (Clapp, 2015). suppose this exact scenario is studied considering the currency fluctuation and reducing the production of crops that are being exported (primarily fruits). In that case, this will reduce water demand by 1.1% and energy demand by 0.6%. Still, this will require an increase in land use of around 9% and a cost increase of more than 100% (due to currency volatility).

In other words, investing in the local production 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.

Computer-based decision support systems (DSS), used to evaluate the scenarios above, are essential in making science-based decisions in the sustainable management of resources. ''DSS must consider wider spatial boundaries that can be customized to different countries and 'regions' specific conditions and complexities. These tools provide graphic and interactive information to address particular problems and the impact of possible solutions in multiple sectors tools provide graphic and interactive information to address problems and the impact of possible solutions in multiple sectors. In the MENA region to facilitate negotiations at the local and regional levels this is important Mohtar, 2020).

Building on the experiences of the Lebanon case study, it is evident that the use of such modeling tools in analyzing different scenarios would enhance a roadmap towards food and nutrition security through exploring beyond zero-sum game solutions. , the following are three-tier approaches:

1. reallocate within the existing primary resources of water, land, and energy.
2. expand the existing primary resources (water, land, energy)
3. create an environment that provides the necessary incentives for allowing the reallocation and expansion of the resources pie.

The types of interventions needed to implement this three-tier approach must include one or more of the following tools:

1) Improved technologies that enhance the use of primary resources;

2) better policies/incentives to protect and promote innovations and investment, and

3) public awareness and change in behavior towards conservation and consumption patterns.

Moving forward

The development of this framework into a scalable tool that use customized WEF analytics to address questions at the country and regional levels can help answer questions within the food and agricultural system related to food self-sufficiency vs economic development.

These analytics could play a role in engaging multi-stakeholders and catalyzing cross-sectoral dialogue around trade-offs and future pathways and development strategies.

It can inform policymaking and national planning as nations work to implement the UN SDGs.

The case study could be adapted and replicated in other countries in the region and other drylands.

Account for resource spatial-temporal distribution, soil suitability maps, and variability and its roles in making these tradeoff decisions.

Understand the preferences and perspectives of the broader group of cross-sectoral stakeholders to evaluate possible interventions and policy changes better.

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Mohtar's research addresses global resource challenges: developing the Water-Energy-Food Nexus framework linking science to policy, characterizing soil-water medium using thermodynamic modeling and non-traditional water applications for sustainable integrated water management. He is a distinguished alumni of American University of Beirut (2014), recipient of the Ven Te Chow memorial award, International Water Resources association (2015) and Kishida International Award (2010).

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