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The importance of the Water-Energy-Food Nexus in the implementation of The Sustainable Development Goals (SDGs)

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Summary

In September 2015, Heads of State met at the United Nations General Assembly to announce the end of the term of "Millennium Development Goals" (MDGs) and commit to a new set of Sustainable Development Goals (SDGs). The 17 SDGs were written by disciplinary teams, and as they are formulated now, they recognize the interlinkages between well-being, economic prosperity and a healthy environment. The SDGs include a wide spectrum of topics and issues: food security, poverty, gender inequality, economic development, climate change, and health, among others. Under each of the Goals is a list of quantifiable targets to be achieved in the coming 10-15 years. Progress toward 12 of these SDGs is directly related to the sustainable use of resources such as land, food, water, energy and materials. The commitment of the Nations to adopt and achieve the SDGs, eradicate poverty, and achieve sustained development that will impact more and more populations, represents an unprecedented opportunity to enter a new era of policy making and resource management. One that can make the integration of social, economic and environmental issues a reality.

Interconnected nature of the SDGs

According to the UN-Department of Economic and Social Affairs (UN-DESA, 2015), a nexus perspective was not adopted in framing the SDGs targets: they failed to recognize the inherent trade-offs and synergies among the SDGs and their targets. Even though the SDGs were written with a global implementation in mind, it is important to note that it is at the local (national and regional) levels that these targets can be achieved. Each country and region has specific geo-climatic, political, socio-economic, and technological peculiarities, as well as differing access to natural resources. The illustration below is an example of Goals 2, 6, and 7 related to food water and energy resources with a corresponding target for each. It is apparent that achieving these targets requires coordination and coherence with involved agencies. Herein, the WEF Nexus approach becomes crucial to understanding the impacts of use of and competition for such resources and to facilitating the adoption of strategies that are relevant to a specific community or country.

Goal 2: FOOD	Goal 6: WATER	Goal 7: ENERGY
2 ZERO HUNGER	6 CLEAN WATER AND SANITATION	7 AFFORDABLE AND CLEAN ENERGY
End hunger, achieve food security and improved nutrition and promote sustainable agriculture	Ensure availability and sustainable management of water and sanitation for all	Ensure access to affordable, reliable, sustainable, and modern energy for all
Target 2.4	**Target 6.6**	**Target 7.2**
By 2030 ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters, and that progressively improve land and soil quality.	By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity	By 2030, increase substantially the share of renewable energy in the global energy mix

Two main issues arise with the implementation of the SDGs. First, as we head towards achieving them, the risk of potential competition between specific targets might cause unintended consequences and further challenges to the progress of the Goal. The second issue is the challenge of measuring progress toward achieving each goal, through the choice of proper indicators, and this challenge is amplified by the lack of local data, or correct types of data.

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There are key questions to ask when adopting strategies to achieve sustainable goals:

1. How are SDG 2, 6, and 7 (with their respective targets) interconnected?
2. How do we assess the impact of water targets upon the food and energy targets and vice versa?
3. What are the trade-offs for implementing SDGs: are there holistic sustainability indexes for multiple implementation plans; how can we provide a platform to evaluate trade-offs in a quantitative and unbiased manner?

Different faces of the Nexus

It is important to clarify that the WEF Nexus is different from Integrated Water Management (IWRM, the water sector), Energy Efficiency (the energy sector) and water productivity (the agriculture/food sector) (Mohtar, 2015). IWRM is defined by the Global Water Partnership (GWP) as 'a process which promotes the coordinated development and management of water, land and related resources in order to maximize economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.' Both IWRM and the Nexus are based on the view that segmented sectorial planning and decision making is likely to lead to unsustainable development pathways and inefficiencies in the development of resources and their allocation between uses and users. Both concepts recognize the need to promote greater co-ordination between inter-linked resource producing and consuming sectors. Both acknowledge the necessity of clearly recognizing that the consequences of decisions made in one sector are experienced in the other sectors. Both concepts have the same emphasis on changing the way policy and decision making occurs in order to improve human welfare and social equity, allow sustainable growth and protect essential environmental resources. Both IWRM and the Nexus are part of the general approach to sustainable development that underpins work on the Green Economy and Green Growth.

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The key difference between them is that IWRM starts with the water resource when considering the interrelationships between water, food and energy.Ideally, the Nexus approach seeks to look at all three elements as an interrelated system, although data and modelling constraints make this a hugely challenging task. In reality, Nexus thinking normally starts from one perspective; that this could be energy or food security makes the concept appear much more relevant to these sectors than does IWRM.

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Trade-Off Analysis

Decision makers require comprehensive tools that (Daher and Mohtar, 2015):

1. Are inclusive of all stakeholders and correspond to the multi-scale nature of the nexus
2. Define and quantify interlinkages of water, energy and land resources
3. Enable the development of an integrated strategy for resource management

One of the analytical tools successfully used to quantitatively analyze the impact of specific water, energy and food security scenarios is the WEF Nexus Tool 2.0 (Daher and Mohtar, 2015). The structure of this tool allows the administrative interface to define local parameters (those which are country or community specific); a second user interface helps the user put forward specific scenarios related to either food security, water security or energy security and which shows the quantitative interaction between resources. The user could, for example, be a government official looking at policy options for implementing SDGs; or an engineer from the industry sector trying to evaluate the impact of different technology choices; or a concerned citizen interested in looking at conservation or sustainability of resources given the current or future status of a community. The WEF Nexus tool delivers several outputs: resource requirements, financial requirements, resource imports, local carbon emissions, carbon-imports, and land requirements. The valuable quantitative data generated is crucial, but it must be noted that one of the major strengths of the tool is its ability to integrate policy inputs to generate social, economic, and sustainability indexes for a given scenario.

A WEF Nexus 'hotspot' (Mohtar and Daher (2016) is a vulnerable sector or region at a defined scale, which faces stresses in one or more of its resource systems due to an allocation of a resource that is at odds with the interconnected nature of food, energy and water resources. Implementing a WEF Nexus framework in the governance of resources allows the identification of such 'hotspots', the accounting for expected trade-offs in resource allocation, and an informed dialogue at the policy level. Generating these dialogue platforms is the key to identifying and clarifying synergistic opportunities for cooperation. Hotspots can differ spatially, depending on land use, population and other spatial information with varying stresses on the system. Hotspots can also vary due to temporal factors, whether long or short term, such as the water stress caused by the intensity of water withdrawal from wells in a specific region for the purpose of energy exploration. It is important that governments identify the most vulnerable hotspots, regions, or themes requiring intervention.

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WEF securities are highly linked and in particular in the semi-arid Arab region, which is energy rich (fossil and solar energy), water scarce, food deficient, and economically and environmentally vulnerable to climate change. The Nexus approach is meant to operate as a catalyst for dialogue between the political economy and the supply chain, and to assist with the move from conflict and competition for natural resources into a cooperative zone in which synergistic solutions can be leveraged. The nexus approach implicitly focuses on policy coherence, thus on identifying hotspots where a specific policy, technology or consumption pattern can be assessed and evaluated. It then focuses on generating a platform for dialogue between multiple levels of stakeholders to enable them to reach informed decisions regarding those synergistic solutions.

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Accountability and Monitoring

The ongoing debate over the choice of the proper indicators to measure progress towards specific targets and the debate as to the degree to which these indicators need to be localized must be addressed. The Arab region's countries will need focused efforts that link the scientific community to policy-makers, and specifically, to establish monitoring mechanisms, devising metrics, enhancing infrastructure and standardizing data. This will allow policy makers to identify their efforts, the challenges, and the science community that will share data and tools to help in implementation of the SDGs and preparation of roadmaps for that implementation.

Key Messages

The targets of the water goal can impact the targets of food and energy goals and as such a quantifiable platform for the interactions of these goals is key to achieving them. This platform must be inclusive with multi-stakeholder approaches to ensure sustainable implementation of these goals. Inclusiveness is imperative and it refers to the sectors (water, energy, food) as well as types (private, public and civil society) of stakeholders. The Water-Energy-Food Nexus offers a useful platform for quantifying and assessing interactions between these goals during their implementation. It is also critical to have transparency and accountability in the Nexus. Monitoring of accountability measures must be undertaken and the decision making process must be kept inclusive and transparent. Measurable, attainable goals for water and energy must be set, with targets for meeting them. Impacts of each of these targets on the other goal and targets must be quantified. Lastly a structure of governance that allow for interaction across sectors must be established.

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Rabi H. Mohtar is a Senior Fellow at OCP Policy Center and TEES Endowed Professor at Texas A&M University, College Station, Texas. He is also an Adjunct Professor at Purdue University. He is the Founding Director of Qatar Environment and Energy Research Institute (QEERI) a member of Qatar Foundation, Research and Development and the Founding Director Strategic Projects at Qatar Foundation Research and Development. He was also the inaugural Director of the Global Engineering Programs at Purdue University, West Lafayette, Indiana.

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 nontraditional 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). Mohtar served on the World Economic Forum Global Agenda Councils on Water Security and on Climate Change (2009-2014). He is a governor of World Water Council since 2012. He has published over 200 published manuscripts include peer-reviewed journals, refereed conference proceedings, books and chapters.

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