



# The water-energy-food nexus Trade-offs, thresholds and transdisciplinary approaches to sustainable development



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## ABSTRACT

Global challenges have exacerbated a search for solutions to poverty and environmental degradation. Integration it was argued would help address the twin challenge. Integrated Water Resources Management (IWRM) was supposed to be that magic bullet and was embraced by scientists because of the clinical efficiency with which it argued for integrated analysis of sectors and resources and of systems and scale conditions. This paper argues that effective implementation of the Water-Energy-Food (WEF) Nexus can be supported by robust science. The corollary that robust science automatically leads to effective implementation is not always known to be true. The nexus approach sheds light on the challenges of implementation by introducing concepts of trade-offs and thresholds and consequently emphasizes the importance of transdisciplinary approaches to sustainable development. This paper reviews the results of recent research to offer tentative answers to the following questions: (a) Why is the governance dimension important to undertake an integrated analysis of water-energy-food challenges? (b) What does the nexus approach connote in normative and institutional terms? (c) What does implementation mean in nexus terms? (d) How can we establish if the nexus approach is an improvement over business as usual? and (e) What tools are available that would enable translation of results of scientific research to create an evidence base that would enable decision makers to act in support of sustainable development?

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## 1. Introduction

The Bonn conference of 2011 propelled the Water-Energy-Food nexus approach into international discussions on sustainable development (Scott et al., 2015; Hoff, 2011). The nexus approach while emphasizing the inter-connections and interdependencies among resources was meant to offer perspectives on how to implement integrated solutions to management of environmental resources without overlooking their implications for the incidence of poverty (United Nations, 2016). The nexus while allowing for a holistic understanding of un-intended consequences of policies, technologies and practices represents a multi-dimensional means of scientific inquiry that seeks to describe the complexity and non-linearity of human-environment interactions (Howarth and Monasterolo, 2016). Since the 2011 Bonn conference global challenges such as urbanization, climate and demographic change have only been exacerbated reiterating the need for integrated solutions often involving complex forms of political negotiation

(Bassel and Mohtar, 2015). Discussions on Integrated Water Resources Management (IWRM) have emphasized issues of integration through an analysis of: (a) inter-sectoral competition for surface freshwater resources, (b) integration of water management at farm, system and basin scales, (c) conjunctive use of surface and groundwater resources and (d) prioritizing water for human consumption and environmental protection (Turrall and Kurian, 1998).

But others have been less optimistic of IWRM pointing out that the approach neglects the political dimension through a focus on “natural boundaries” and “neutral planning and participation” (Wester and Warner, 2002: 65). It is precisely this critique of IWRM that the nexus approach can respond to by providing an improved understanding of what measures advance effective implementation in support of sustainable development (Kurian and Ardakanian, 2015). The nexus approach sheds light on the governance dimension by introducing concepts of trade-offs, synergies and thresholds (Mohtar and Daher, 2014). Testing the applicability of the nexus approach has inadvertently put a spotlight on the following concerns: (a) Why is the governance dimension

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important to undertake an integrated analysis of water-energy-food challenges? (b) What does the nexus approach connote in normative and institutional terms? (c) What does implementation mean in nexus terms? (d) How can we establish if the nexus approach is an improvement over business as usual? and (e) What tools are available that would enable translation of results of scientific research to create an evidence base that would enable decision makers to act in support of sustainable development?

The critique of IWRM is well founded because it overlooks the importance of administrative boundaries. Administrative boundaries are important from an implementation point of view since they capture the hierarchy that is implicit in authority structures that shape multi-level governance of environmental resources (Golam and Sharma, 2015). The issue of authority structures highlights the need for an institutional framework to examine sector-bound decisions characterized by poor participation mechanisms and taken with little consideration for the effects of those decisions on other sectors leading to rebound, cascading and other negative effects that are exacerbated by mutual interdependencies between resources, services and risks (Howarth and Monasterolo, 2016). This paper argues that effective implementation of the Water-Energy-Food (WEF) Nexus can be supported by robust science. The corollary that robust science automatically leads to effective implementation is not always known to be true. This assertion is made based on the experience of the IWRM approach to management of environmental resources. In this connection this paper raises three questions to emphasize that the WEF nexus is a significant departure from IWRM approaches to management of environmental resources:

- What is the role of political negotiation in influencing governmental interventions that address issues of sustainable development?
- How do norms, institutions and organizational structures and processes shape nexus trade-offs and thresholds to public action in environmental planning and management? and
- What are the applications of transdisciplinary approaches in the design of research, training and policy advocacy interventions that address the complex and non-linear relationship between poverty and management of environmental resources?

This paper has three objectives. First, the paper attempts to provide the broad contours of an institutional framework that can inform discussions focused on implementing the nexus approach. Second, the paper elaborates upon concepts of trade-offs and thresholds to public action to highlight the implications of the nexus approach for public policy formulation, implementation and monitoring. Finally, this paper emphasizes the importance of transdisciplinary approaches to research, training and policy advocacy that can potentially advance nexus oriented strategies in environmental planning and management.

## 2. Norms, institutions & organizations for management of environmental resources

There is a rich theoretical literature on *externalities* that highlights the rationale for governmental intervention in addressing issues of sustainable development (Ostrom, 1990). Common Pool Resources (CPRs) such as forested river catchments are examples of resources that have been under governmental control. Despite being the recipient of investment for infrastructure such as dams that translates resource availability into critical services for a tax paying populace, improper management of forested catchments for example, can lead to soil erosion and compromise the lifecycle of constructed infrastructure (Reddy

and Kurian, 2015). The inability to manage critical public infrastructure such as dams can have knock on effects on food production and food security. Governments play an important role in providing the poor a safety net by mitigating the effects of climate or institutional risks that arise from improper management of not just environmental resources but public services that arise from infrastructure management (Golam and Sharma, 2015).

Climate, geography and demography are all known to influence norms, institutions and organizational structures and processes for management of environmental resources (Fukuyama, 2012). This is because climate and geography may influence the intensity, frequency and incidence of risks that populations face. Yet historically governments are known to prioritize investments in infrastructure in regions with significant material resources for populations with considerable influence over the political process (Witfogel, 1957). From an analytical perspective the response of governments to challenges of environmental management may be reflected in norms (*example: inter-governmental financing*), institutions (*example: rules that guide water pricing or infrastructure maintenance*), organizational structures (*example: horizontal versus vertical tiers of government/departments*) and organizational processes (*example: levels of administrative discretion*) (Pollitt and Bouckaert, 2000).

In addition to the issue of political and administrative decentralization that the above discussion alludes to is the more focused discussion on the types of budgeting structures and processes (Bjorkman, 2010). While it is true that budgets have evolved in response to a growing emphasis on efficiency in the wake of the Reagan-Thatcher revolutions, there has been growing scrutiny of the outcomes of development aid. This emphasis on outcomes has also put a spotlight on the assumptions that development agencies and practitioners have held about the relationship between poverty and the environment. For example, it is a commonly held view that poverty leads people to degrade the environment and that environmental degradation can affect poverty (Lall, 2015). But our research shows that scale conditions can play an important role in defining the exact outcomes of the relationship. This has important implications for budgeting approaches- budget versus sector wide approaches, for example and their influence in defining environmental outcomes specifically and impact more generally on poverty (Suardi and Kurian, 2015).

The above discussion should underline the fact that the relationship between poverty and the environment is characterized by complexity and non-linearity (Scoones, 1999). The nexus approach by departing from the “neutral planning” philosophy of IWRM embraces the political nature of decisions that relate to infrastructure and service delivery. This departure signifies that political considerations may clinch crucial arguments over policy, program and project interventions when compared to purely scientific ones. There may be important trade-offs that are made with political support between equity and efficiency, for example. Environmental resource management may not automatically influence poverty and poverty may not be affected by environmental management. There can only be one way of establishing if the nexus is an improvement over IWRM in terms of overall sustainable development- by implementation. Effective implementation is normally backed by robust science. The corollary that robust science automatically leads to effective implementation is not always known to be true. This is the key lesson that is emerging from research on the nexus approach to management of environmental resources (Kurian and Ardakanian, 2015).

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