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Regulating the water-energy-food nexus: Interdependencies, transaction costs and procedural justice

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ABSTRACT

There have been calls for an overhaul of regulatory and governance frameworks to incorporate the implications of the water-energy-food nexus. We map one small component of the regulatory space of the nexus and highlight its immense complexity. We draw on insights from the economics and socio-legal literatures to show that a decentralised approach to regulation based upon procedural justice can enable the trade-offs of the nexus to be considered and addressed. We use a nexus case study of micro hydro-electricity generation in Dartmoor National Park in England to show that when we take into account interactions between state and non-state regulation, the economic concepts of interdependencies and transaction costs, and a recognition that regulation of the nexus is a process involving decisions of procedural justice, some existing regulatory frameworks are already well-equipped to deal with the implications of nexus analysis.

1. Introduction

From the water-energy-food nexus' very early days some have argued that the adoption of nexus analysis by policy makers will require new regulatory and governance frameworks (Hoff, 2011). For instance, Sharmina et al. (2016: 81) call for 'a radical overhaul of the current system of policy- and decision-making' to avoid the current practice of compartmentalised government policy and regulation (see also Leck, 2015). While the form of the 'radical overhaul' called for is not always spelled out, there is an implicit (and sometimes explicit) expectation that current regulatory frameworks should be replaced by centralised and technocratic decision making processes that aim to draw on objective science (e.g. Bazilian et al., 2011; Cairns and Krzywoszynska, 2016).

This paper provides a framework for thinking about how to regulate the nexus and how to map the regulatory space of the nexus. We conclude that while regulators have much to learn from nexus analysis, in particular the identification and quantification of interconnections and interdependencies, the nexus does not require a radical overhaul of regulatory and governance frameworks as some have suggested. Using micro hydro-electricity generation on farmland in Dartmoor National Park in England as a case study, we show that a regulatory framework built around the principle of procedural justice and that recognises the concepts of interdependence and transaction costs has the ability to generate efficient outcomes and consider trade-offs among the sectors of the nexus.

1.1. Regulation and its sources

In order to understand how to regulate the nexus, it is important to consider what regulations are and where they come from. At their most simple, regulations are constraints on behaviour. These constraints consist of rules that often carry sanctions for non-compliance.[1] These rules can prohibit certain actions (such as the dumping of animal waste in waterways) or impose imperatives that require certain actions to be done (e.g. requiring that planning permission is obtained before building a hydro-electric power plant on your farm).[2]

The state is the most obvious source of regulation. It generates regulation in almost every sphere of life; including the use and production of water, energy, and food. In many societies, there are multiple tiers of state regulation, including at the national/federal,

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[1] North (1990: 3) defines institutions as the 'rules of the game in a society', or 'constraints that shape human interaction'. North sees institutions (or regulation) as structuring the incentives associated with human exchange, whether it is political, social, economic, or environmental.

[2] In addition to regulation (that constrains behaviour) there are also governance tools that aim to provide rewards/incentives to encourage certain behaviour. In terms of the case study presented below, the most prominent would be agricultural and renewable energy subsidies. This study focuses solely on the regulatory aspects of the nexus.

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province/state, and local/council levels. In addition, there are many international agreements and treaties that regulate the consumption and production of water, energy, and food that are normally enforced by nation states.

However, the state is not the only source of regulation. Ostrom (1990) famously highlighted how non-state organisations (with varying degrees of formality) regulate natural resources in a variety of situations and societies. Ellickson (1994) has shown how the cattle ranchers in California largely govern themselves using informal rules (or social norms) that have been developed and are enforced without the state or any other centralised authority. Social norms can be enforced by other members of society who adhere to the same norms; for instance, when a litterer or queue jumper is rebuked by a member of society when a norm is broken. However, many norms (and laws) are internalised by individuals. In these instances, once a rule is internalised a psychological penalty (e.g. guilt, shame) can apply to the act, which can regulate the behaviour in question (Cooter, 1998; McAdams and Rasmusen, 2007). In addition to social norms, any individual that belongs to an organisation, whether it be a farm, family, company, religious group, club, university will be regulated by them. While many of these may have little impact on water, energy, or food – many do. For instance, some firms adhere to sustainability principles that generate prohibitions and imperatives at the workplace in terms of energy use, recycling, and waste disposal that go beyond state regulation (Karassin and Bar-Haim, 2016). Many religious groups impose imperatives and prohibitions that influence the consumption and production of food (McCullough and Carter, 2013).[3]

In terms of how state and non-state regulations interact, they may substitute or complement one another, or even generate dissonance effects. In terms of complementarity, non-state regulations may be in force in addition to state regulations.[4] In other cases, there may be no social regulation attached to a certain activity, as it may be deemed to be morally neutral in a given community, whereas such behaviour may be prohibited under the state regulatory framework.[5] The reverse can also be the case, where a given behaviour is deemed to be wrong under the prevailing social norms of a given community but state regulations may not prohibit it.[6] Indeed, there may even be cases where state and non-state regulations push people in opposite directions, generating legal or regulatory dissonance (Larcom, 2015).

There are many sources and forms of regulation and this can result in a multi-layered regulatory environment for even the simplest of activities. However, acknowledging this complexity is necessary; otherwise a distorted or incomplete picture of the regulatory environment will be generated. Combining this regulatory complexity with the complexity of the nexus, which explicitly aims to examine cross-sectoral interdependencies and complexities itself, is a formidable task. Fig. 1[7] provides a skeletal framework for mapping the regulatory framework of the nexus. The-left-hand-side lists the different sources of regulation, broadly categorised into state and non-state regulation. The right-hand-side lists the main components of each of the sectors of the nexus. As can be seen, there are 6 broad sources of regulation and 45 broad components within the three nexus sectors, of water, energy and food. While it will depend on the number of sources of regulation and number of regulations from each source for each specific component of the nexus, it can be seen that understanding the regulatory environment of the nexus is a complex task. Indeed, if each of the 6 sources of regulation had 10 individual regulations for each of the 45 broad components (a very conservative estimate), there would be 2700 individual regulations to consider. This demonstrates that regulation of the nexus is an incredibly complex task, and increases the complexity of nexus analysis by many magnitudes.

1.2. Procedural justice, interdependencies, and transaction costs

As Fig. 1 suggests, even for one component of one of the sectors of the nexus there are a multitude of regulations from multiple sources, and many of these regulations and their sources are place and activity specific. This raises an important question in terms of the nexus: how can we map and design a regulatory framework to account for all of the interactions and interdependencies of the nexus? The complexity of regulation surrounding each component of the nexus combined with the complexity of the nexus itself would seem to make it a formidable task. Despite the complexity involved, we argue that policymakers and regulators already have the tools at their disposal to account for the interdependencies and complexities that are highlighted by the nexus. In particular, we argue that a regulatory framework built around the principle of procedural justice and that recognises the economic concepts of interdependencies and transaction costs has the ability to generate outcomes that allocate resources in a broadly efficient manner, and that enables the various trade-offs among the sectors of the nexus to be considered. Before embarking on our analysis, we briefly define each of these three concepts and their relevance to nexus analysis in order to make them readily identifiable when we present our case study.

At its most basic, procedural justice is a decision making process that is recognised as being fair, where stakeholders can participate in the process and where their values and preferences are recognised (Schlosberg, 2009; Wood et al., 2016).[8] As the outcomes are likely to be more favourable to those who are afforded participatory opportunities, if a broad spectrum of stakeholders is able to meaningfully participate in the process and have their values and preferences accounted for, procedural justice has the ability to provide a path towards distributive justice and efficient resource allocation.[9]

The concept of interdependence refers to a situation where the choices of one agent influence the choices of another. Interdependence leads to conflict when the choices of agents are incompatible. By implication, resolving these conflicts necessitates making a choice over which agent's or agents' interests are prioritised and to what extent (Bromley, 1991; Adger et al., 2003).

[3] There is a vast literature on environmental regulation more generally and the factors that affect real world behaviour. For an overview for instance see Percival et al. (2013).

[4] For example, farmers who are known to dump animal slurry in waterways may be ostracised within farming communities and also face state regulations and penalties.

[5] One such example is that farming communities may be indifferent to tree clearing to increase beef production, whereas strict state regulations may apply (Seabrook et al., 2008).

[6] For example, in some communities those who build and operate wind turbines may face social sanctions due to concerns over loss of visual amenity, whereas they may be free to do so under the state legislative framework.

[7] Nexus relevant components of each of the nexus sectors is drawn from Bazilian et al. (2011) and adapted by the authors. Note that this relates to direct regulation and components, and does not include the effect of regulation on indirect drivers of nexus resource use, including demographics, economic growth, and science and technology.

[8] There are multiple models, ideas and definitions of procedural justice (e.g. see Rawls, 1999).

[9] Distributive justice helps understand which agent's interests will be affected and how they will be affected by establishing, changing or reaffirming regulation. Procedural justice, with its focus on understanding which agents are able to participate in the regulatory design process and the balance of power between agents and regulators, can help justify decisions that may be difficult to achieve from a purely distributive justice point of view (Paavola and Adger, 2005 and Sagoff, 2008).