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# Node and Regime: Interdisciplinary Analysis of Water-Energy-Food Nexus in the Mekong Region

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**ABSTRACT:** Understanding complex phenomena such as the water-energy-food nexus (resource nexus) requires a more holistic, interdisciplinary inquiry. Spurred by a sense of imbalance in approaches to the nexus dominated by integrated assessment/complex systems methodologies, I re-examine the findings and recommendations of a major 'nexus' research-for-development project in the Mekong region. The concept of 'regime of provisioning', a synthesis of social science concepts related to meso-level social order, allows essential political economy and discursive elements of the resource nexus to be analysed. I show that socio-political regimes constrain societal investment in three 'nodes' of the nexus previously identified as critical to manage sustainably: energy efficiency, wild-capture fisheries, and diversified smallholder agriculture. I discuss implications for the 'nexus' as a new policy agenda and offer three propositions for ongoing inquiry and inclusive practice.

**KEYWORDS:** Water, energy, food security, nexus, critical social science, complex systems, Mekong region

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## INTRODUCTION

Building on advances in integrated assessment models (e.g. Bazilian et al., 2011), policy discourse around the need to understand linkages between climate, land, energy, water, and food (hereafter, 'resource nexus' or 'the nexus') re-emerged around 2011, with a series of conferences in Bonn.<sup>1</sup> Nexus thinking has a variety of influences including input-output analysis and the systems analysis work of *The Limits to Growth* (Meadows et al., 1972; Bazilian et al., 2011; Overseas Development Institute, European Centre for Development Policy Management and German Development Institute, 2012). The normative principles which inform contemporary thinking around the nexus include sustaining ecosystems and their services, creating more with less, accelerating access, and integrating the poorest (Hoff, 2011). These principles are driven by the argument that globally, population growth, economic development and urbanisation have increased demand for resource-intensive foods such as fruits and vegetables, oils, and animal protein. Under dynamics-as-usual, agricultural production will need to expand 70% by 2050, and agricultural water demand by at least 20% (Hoff, 2011: 10; for critique see Tomlinson, 2013). By 2012, commentators were already referring to the need to 'manage' the nexus as if it had become a relatively well-defined class of problems, one that could be quantified using integrated assessment tools, and addressed via capacity building and other improved managerial and governance responses (Hoff et al., 2012).

In fact, as I will show, the nexus is an immature concept. As with the concept of integrated water resources management (IWRM; Mukhtarov and Gerlak, 2013), it requires more critical conceptualisation. The more that integrated assessment techniques advance (e.g. Yates and Miller, 2013), the more apparent it is that social science conceptualisations of the nexus remain limited. For

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<sup>1</sup> Sponsored by donors such as the German Ministry for Education and Research, Global Water System Project, and UNEP.

example, it is common to find strong statements about the need to (1) reduce inequality in access to food, water, and energy (through means such as increased international cooperation); and (2) harmonise potentially conflicting policies and regulations (by clarifying for decision makers trade-offs between the domains, using modelling tools) (Bazilian et al., 2011). Such statements are however not yet accompanied by a rigorous analytical framework that includes the nexus between financial investment, the developmental state, different classes of people, and distributional outcomes on the ground.

In their enthusiasm for identifying perverse outcomes, increasing resource use efficiency, and promoting adaptive governance, contributors to the nexus literature using integrated assessment or systems dynamics (Hermann et al., 2012; Howells et al., 2013), have neglected to examine *how* energy, water, and food have been produced, historically, under particular social formations (Hermann et al., 2012; Howells et al., 2013; cf. Harvey, 2011). For example, they have not seriously asked how, under particular social regimes, farmers and workers are organised so as to produce not only resources, but also profit, power, and social change (Harvey, 2011; Hall et al., 2011). Thus, the social dimensions of resource linkages remain thinly described and under-theorized.

This paper offers a concise interdisciplinary analysis of the Mekong resource nexus, based on a critical re-examination of findings based on complex systems thinking (Smajgl and Ward, 2013a). I argue that critical social sciences offer important contributions, potentially in synergy with the dominant complex systems approach to thinking about the nexus. By emphasising the need for more vigorous thinking around the political economy of energy, water, and food linkages, the essay aims to redirect applied research work on the resource nexus.

The paper is directed at several audiences. In arguing for a revised approach, we argue with experts on the nexus who appear to regard its framing as sufficiently pro-poor (e.g. Hoff et al., 2012). A second vital audience consists of researchers interested in critical interdisciplinary work. Advisors to movements defending poor peoples' access to land, water, fisheries, and other natural resources may find our critical analysis of the nexus – as an insufficiently pro-poor but potentially empowering policy agenda – to be of interest.

Section 2 reviews two approaches to thinking about the resource nexus: the dominant approach, which is based on complex systems thinking, and a contrasting approach, based on critical social sciences. Section 3 presents a case study drawn from a major research project in the Mekong region in which the author was involved. I show the limitations that ensue when a complex systems approach dominates the analysis. Section 4 shows how critical social science furthers our understanding of the Mekong case study. Section 5 provides a synthesis and conclusion, presenting several propositions to advance a critical research agenda.

## TWO APPROACHES TO UNDERSTANDING THE NEXUS

Understanding the resource nexus requires addressing two related, but distinct topics of inquiry. The first might be summarised as the systems complexity of the nexus. It seeks answers to questions such as "how do efforts to increase variables of interest in domain *a* (e.g. food production), affect other variables of interest in domains *a*, *b*, *c*, *d*?" This topic seeks understanding of systematic connections between domains. Disciplines such as economics, hydrology, engineering life cycle analysis, scenario analysis, and systems analysis have been used to describe such connections (Mukherji, 2007; Newell et al., 2011; Bazilian et al., 2011; Hoff, 2011; Hussey and Pittock, 2012; Howells et al., 2013; Yates and Miller, 2013). Findings are conveyed in terms of efficiency, productivity, trade-offs, synergies, and co-benefits.

The second topic might be labelled the critical social science of the nexus. It involves the power relations that underpin a given resource nexus. These relations have historical, cultural and socio-

political dimensions. This topic raises questions such as: "[h]ow has the resource nexus in a particular place emerged, historically? Which social groups are enriched (impoverished) by a particular resource nexus? Who gains or loses from attempts to intervene in the nexus?" (Foran and Manorom, 2009; Friend et al., 2009; Molle et al., 2009b; Barney, 2012).<sup>2</sup>

Table 1 shows two selected conceptual approaches with strong logical connections to each of the above topics.<sup>3</sup> A holistic understanding of complex phenomena such as the resource nexus requires some kind of interdisciplinary inquiry. Because the two approaches differ in focus, theoretical processes, typical sequence of analysis, and techniques, combining them is analytically intensive (Foran et al., 2014a), and presents challenges of epistemology. For example, critical social science insists on the importance of understanding context, understood as contexts of social structure (e.g. institutions) as well as contexts of meaning, such as the meaning given by narratives (Whittier, 2002; Foran, 2006; Lejano et al., 2013). Because it regards meanings (ideas, discourses) as having a causal force, it regards social systems as open. This leads critical social science to take a more sceptical view of claims that social-ecological systems essentially have cyclic properties, regardless of historical development (Walker et al., 2004), or that concepts such as 'peak oil' exist independently of social forces such as speculation in oil markets (Harvey, 2011: 77). However, Table 1 shows that each approach has limitations that could be potentially bridged by the other, and thus an interdisciplinary analysis based on synergies between the two approaches is worth pursuing (Foran et al., 2014a). We discuss opportunities for a more holistic, integrated understanding of the resource nexus in Section 5, after considering a case study heavily influenced by complex systems thinking.

## MEKONG CASE STUDY

The case study shows how the resource nexus in the Mekong region has been explored using a complex systems thinking approach, supplemented with insights from political ecology (Foran et al., 2013; Smajgl and Ward, 2013c). With a growing population of 271 million, the Mekong region has a youthful and expanding workforce, with significant movement out of smallholder agriculture, although most people still live in rural areas and are involved in agriculture (Foran et al., 2013). The region is economically and politically diverse, consisting of three so-called least-developed economies (Cambodia, Lao PDR, and Myanmar) and three diverse larger economies (Thailand, Viet Nam, and Yunnan Province of China).<sup>4</sup> As one indicator of this diversity, the proportion of national populations employed in agriculture ranged from 39% in Thailand to a high of 90% in Yunnan (Bouapao, 2013), while the proportion of food spending in total household spending ranged from 39% in Thailand to 70% in Cambodia (Fullbrook, 2013). Business leaders and policy makers display strong ambitions to expand trade, mining, manufacturing, transport, tourism, and industry (Foran et al., 2013). Notwithstanding the 2008 global financial crisis, some observers project the Mekong region to grow rapidly: GDP growth rates for 2010-2017 range from 5-9% per annum (IMF, 2012).

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<sup>2</sup> Political ecology also asks how development-induced ecological change in turn influences narratives and social orders (Forsyth, 2003). I thank a reviewer for emphasizing this point.

<sup>3</sup> The IAD framework (Ostrom, 2007) is also highly relevant but not elaborated here as it does not theorize differential power and interests (Wittneben et al., 2012: 1439). IAD has strong connections to social-ecological systems (SES) thinking, a complex systems approach which has popularized concepts of resilience, social learning, adaptive governance, and polycentric governance (Folke et al., 2005; Foran et al., 2014a; Walker et al., 2004).

<sup>4</sup> The 'Greater Mekong Subregion', a regional cooperation program, also includes China's Guangxi Zhang region.

Table 1. Two approaches towards the resource nexus.

Characteristic properties	Approach	
	Complex systems thinking	Critical social science
Focus	Cross-level, cross-domain impacts of particular actions	Historical determinants of vulnerability, insecurity, or poverty in specific places Winners and losers from particular actions
Key processes	Absolute limits (biophysical, social) (Rockström et al., 2009) Interactions between reinforcing (positive) and balancing (negative) feedback (Sterman, 2000) Cross-domain interactions Unintended consequences Learning	Capitalist accumulation Market imperative Dispossession Institutions  Discursive power Difference and stratification (e.g. gender, caste, class)
Common sequence of analysis	(Macro ->) Meso -> Macro	Micro -> Meso -> Macro
Specific techniques	Quantitative modelling Scenario analysis	Historical analysis Critical discourse analysis In-depth actor interviews Ethnography
Limitations	A relatively unsophisticated social and political analysis	Relatively unsophisticated analysis of system dynamics

Source: Author, based on Foran et al. (2014a).

### Exploring Mekong Region Futures Project

The idea of an action research project to explore alternative futures of the Mekong region was floated in 2008, during the annual meeting of the M-POWER<sup>5</sup> research network. The idea's initial proponent had commitments, consistent with a critical social science agenda, towards enhancing social justice, pursued through engagement in and analysis of water and energy governance dialogues in the Mekong region (Dore, 2007). The *Exploring Mekong Region Futures* project (2009-2013)<sup>6</sup> had two linked objectives: the first was a desire to conduct a series of scientific assessments in order to understand how development decisions in one local area might ripple through the region. Second, the project wanted to engage with middle-level government agency decision makers in various countries of the region, for the purpose of understanding their visions for development, their causal beliefs, as well as – upon interaction with assessment findings – the potential for beliefs or visions to change (Smajgl, 2010; Smajgl and Ward, 2013b).

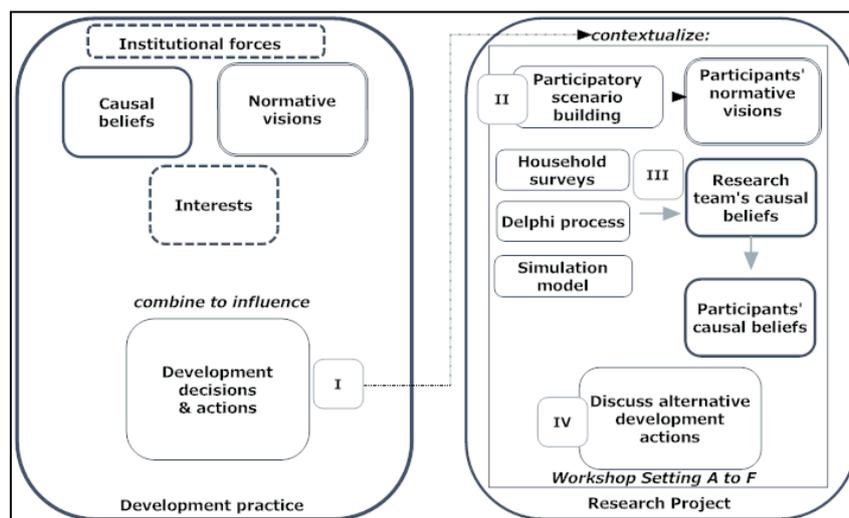
<sup>5</sup> Mekong Programme on Water, Environment and Resilience.

<sup>6</sup> Funded by the AusAID-CSIRO Research for Development Alliance.

### Delphi process

To generate findings and recommendations regarding the resource nexus, the project made use of several discrete methods, including household surveys, the construction of an agent-based model, and the use of a Delphi process (see Figure 1). The author was a participant and observer in the latter process.

Figure 1. Design of the Exploring Mekong Region Futures Project.



Source: Foran et al. (2013). Note: prevailing discourses (left hand side) influence participant visions and causal beliefs; connections not depicted.

As implemented by the project, the Delphi (expert panel) process began with a 2009 workshop for specialists. The workshop converged on a set of six development initiatives (proposed or already unfolding in the region) with potentially important impacts at the regional level:

1. A series of 12 hydropower dams on the lower mainstream Mekong (including Xayaburi and Don Sahong), combined capacity 12.98 GW, supplying up to 64.3 TWh of energy/yr.
2. Water diversion from Lao PDR into Northeast Thailand: up to 300 m<sup>3</sup>/sec throughout year (6878 million m<sup>3</sup>/yr), representing approximately 50% of dry season flow in Lao PDR source rivers.
3. Adaptation to sea-level rise in the Mekong delta (20 cm by 2030), with salinity intrusion and storm surges.
4. Rubber expansion (1.6 million ha by 2030), assuming 50% are large plantations.
5. Railway expansion (e.g. Bangkok-Phnom Penh-Ho Chi Minh City-Hanoi-Kunming/Nanning, 4537 km).
6. Bauxite mining and possible alumina production (1.0-2 million t bauxite extraction per year).

The project commissioned six analysts to assess impacts of the nominated development initiatives on a given 'sector'. The assigned sectors were: water (Pech, 2013); food security (Fullbrook, 2013); the Mekong energy system (Foran, 2013b); livelihoods and migration (Bouapao, 2013), land use (Lu, 2013), and mining (Lazarus, 2013). Analysts received a common, minimal description of the developments. They were asked to assess impacts singly, and then assess the cumulative impact on their assigned sector if all six developments began to be implemented in the near future.

Next, the project leaders organised a workshop in which the assessment authors presented their work-in-progress. The group then discussed the first, second, and higher-order effects of proposed developments. This was done using a deliberately decontextualising technique where a potential outcome was to be discussed without reference to any prior chains of cause and effect (i.e. as the outcome of only an immediately prior cause) (Smajgl and Ward, 2013c: 14-15). The preceding activities took almost four days. The project leaders then led a short plenary discussion of system diagrams they had created listening to the group discussion. This was followed by a post-workshop analysis of system diagrams by project leaders.

### *Findings*

Published as *The Water-Food-Energy Nexus in the Mekong Region* (Smajgl and Ward, 2013c; 'Mekong nexus book'), the findings included six chapter-length sectoral assessments and a set of qualitative systems diagrams. The final chapter of the book was a "cumulative cross-sectoral assessment" (Smajgl and Ward, 2013a) which presented several key arguments. The first was that construction of 12 hydropower dams on the mainstream Mekong River was likely to lead, via hydrological changes, to net negative impacts on livelihoods in Cambodia and Vietnam (because of loss of access to wild fish and net negative impacts on agricultural production in the Mekong delta). Upstream in Thailand and Lao PDR, a mix of positive and negative impacts on agricultural livelihoods was expected (Smajgl and Ward, 2013a: 211). Although employment in mining and rubber development, along with increased dry season irrigation and aquaculture, could improve affordability of food (assuming stable food prices), "none of the other... development strategies are predicted to have the potential to mitigate the hydrological impacts of mainstream dams" (p. 217).

The most important argument was the claim that a set of potential intervention points, referred to as 'critical system nodes', existed (Table 2). The nodes were important because many outcomes hinged on how they were managed, independently of whether the six development initiatives proceeded or not.

### *Critical reflections*

In a world where dominant interests make it difficult to prohibit the construction of dams on the Mekong mainstream, or large rubber plantations, or water diversions, the idea that critical nodes exist in the system is appealing, and potentially an important insight. The ability to manage critical nodes, according to Smajgl and Ward (2013a), could avoid "triggering unintended ripple effects", preventing worst-case scenarios. Moreover, with a "thorough understanding of the connectivity of the system" it might be possible to design "alternative development investments" that could trigger "positive ripple effects" (Smajgl and Ward, 2013a: 218). The third column in Table 2 shows those alternatives.

The concept of critical nodes is promising, but falls short of delivering in-depth understanding. In order to begin to do so, several weaknesses must be addressed. First, the term 'node' is not well specified. What exactly is a node? Smajgl and Ward (2013a: 218) state that "nodes represent a constellation of factors that combined, influence the degree of nexus linkages, and as a corollary, livelihood outcomes and poverty levels". The empirical examples in Table 2 tantalise us with their diversity with respect to complexity, geographic scale, and temporal duration.

Having proposed a concept which admits great diversity, Smajgl and Ward (2013a) do not defend the concept's utility or integrity with a discussion of fundamental properties. The notion that a node is a 'constellation of factors' suggests that it could be regarded as a complex process (Merton, 1968; McAdam et al., 2001). If so, what activates the process and what sustains it? For example, is the presence of all sub-components sufficient to activate a process, or do sequencing or the presence of other contingent processes matter? Given repeated claims that a thorough understanding of connectivity is vital, the authors' silence regarding the theoretical properties of nodes is disappointing. If we are to identify them and manage their interactions, nodes cannot remain under-theorized.

Table 2. Mekong water-food-energy nexus: critical system nodes.

Node	Issue	Recommendations (Smajgl and Ward, 2013a)
Fish stocks	Critical resource: requires careful management and new governance solutions independently of mainstream dams	Regional monitoring and governance system for fishing and fish migration, with effective enforcement
Energy demand	Critical to manage separately from power supply	A raft of initiatives including building and construction ordinances
Land use change and irrigation	Monoculture dependency increases risks in the nexus	Consumer choice Incentives to minimise extensive development of monocultures
	Impacts highly uncertain	Investment to improve productivity of smallholders
	Managing to alleviate poverty leads to more sustainable development	Regulating foreign direct investment to protect existing tenure
Migration	Depend on available livelihood options	Lower uncertainty and improved returns in food system lowers risk of large-scale migration
Labour shifts	Influences political stability Given shifts from primary to secondary employment (as part of urbanisation trend), social and economic stability requires investment in urban infrastructure and maintaining rural livelihood options	Stabilise incomes in rural communities to decrease urban influx

Source: Author, based on Smajgl and Ward (2013a: 218-219).

Second, the approach to problem definition, in which second-order and higher-order outcomes are to be discussed inductively, divorced from initial causes, implies a co-variation-based, law-seeking model of causation. Is this the most appropriate model of causation? If uncertainty and complexity are indeed to be taken seriously, the links between cause and effect, between premise and conclusion, cannot be isolated to *proximal* cause and effect, but should also include circumstantial premises, for example, statements about historical and social conditions that when taken together, help justify arguments about causality (Fairclough and Fairclough, 2012). If, as the authors argue, 'emergence' is to be taken seriously (Smajgl and Ward, 2013c: 218-219) a social process-based model of causation seems to be more appropriate, a model in which conceptually defined social and ecological processes ('mechanisms') may produce varying outcomes, depending on initial conditions (including the social context they are activated in) and on the presence of other mechanisms (Tilly, 2001; Mayntz, 2004; Foran, 2006).

Third, Smajgl and Ward (2013a) are not the first to point to the crucial importance of capture fisheries management, energy demand management, and large-scale irrigated monoculture development. Table 3 shows that engineers, and social and environmental scientists have already entered the literature to critically describe and analyse these Mekong region issues. They have offered reform recommendations (Table 3, third column) based on dedicated analysis of how consequential issues ('nodes') emerge as a consequence of power-laden social relations in each domain (Table 3, second column). Fourth, suggestions which call for more effective fisheries management, or electricity

Table 3. Critical system nodes: Contributions from critical social sciences.

Node	Recommendations based on complex systems thinking (Smajgl and Ward 2013a)	Critical social sciences	
		Influential regime processes	Recommendations
Fish stocks	Effective regional monitoring and governance system for fishing and fish migration	Framing of wild-capture fisheries as inevitably doomed, backward leads to investment in culture and stocked reservoir fisheries (Friend et al., 2009)	A counter-narrative: Capture fisheries as an integral part of a diversified livelihoods portfolio; a resource with multidimensional benefits; with multiple examples of sustainable and equitable management by local communities (Arthur and Friend, 2011)
Energy demand	Building and construction ordinances	Financial regulation of utilities	Strengthening existing, successful appliance standards and labelling programmes
	Consumer choice	Engineers' mental models of reliability (energy efficiency vs. new power plants)	Treating energy efficiency as a resource on par with the supply side, through integrated electricity resource planning
		Labour movement against utility restructuring, NGO advocacy to reform electricity planning processes	More authentic participation in power planning and approval
		(Greacen and Palettu, 2007; Foran, 2006, 2013a; Greacen and Greacen, 2004)	(Foran et al., 2010a; Foran, 2013a)
Land use change and irrigation	Minimise extensive monoculture development	Alignment between large-scale agriculture and state developmental interests (controlling and accessing budgets) (Blake et al., 2009)	Multi-stakeholder debate and dialogue
	Investment to improve productivity of smallholders	Populist regional development planning (e.g. greening <i>Isan</i> ) (Molle et al., 2009a)	Civil society advocacy
	Regulate foreign direct investment to protect existing tenure		(Molle et al., 2009c)
			Regulation of land markets to prevent inequality in land distribution (Akram-Lodhi, 2013)

Source: Author, based on references cited.

demand management, beg the question of why fisheries or electricity demand management is ineffective. Without a dedicated discussion of historical causes, solutions proposed by Smajgl and Ward (2013a) invert the problem framing, resulting in a tautological argument (Wodak and Meyer, 2001: 76). The remainder of the paper extends the third and fourth points of critique summarised above.

## APPROACHING THE NEXUS FROM A CRITICAL SOCIAL SCIENCE PERSPECTIVE

### Basic concepts

Critical social science offers both conceptual and empirical insight into the structure of the critical system nodes putatively identified by Smajgl and Ward (2013a). The conceptual framework presented here has been influenced by approaches in politics and sociology that aim for a comparative understanding of stability and contention, an understanding that attempts to synthesise fundamental concepts such as *discourses, institutions, and interests* (John, 1998; Lichbach and Zuckerman, 1997; McAdam et al., 2001).

Each conceptual object above can be defined to have certain causal powers (denoted '+' below) and liabilities ('-'), which allow them to influence and be influenced by other objects in the conceptual framework:

*(Micro) Discourses* (e.g. a particular argument)

(+) can frame problems and legitimate solutions

(+) regulates boundaries of knowledge

(-) needs to resonate with an audience's experience, beliefs, and empirical 'facts'

(-) may change when different actors contribute

*Institutions* (core rules, practices, durable macro-discourses)

(+) can regulate practices and micro-discourses

(-) can be changed via collective action and argument

*Individual interests* (e.g. security, livelihood)

(+) engage in mobilisation (e.g. elite-driven reforms, protest campaigns, counter-movements)

(+) engage in rhetorical action

(-) can be coerced, co-opted, persuaded to change (via discourse, collective action and material changes)

Source: Adapted from Foran (2006).

### Regimes of provisioning

Building on the three basic concepts and their interactions, the concept of a 'regime of provisioning' may help guide analysis of the discursive and institutional constraints on change in food, water, or energy systems, as well as possibilities for strategic action.

Regimes of provisioning can be understood as having three dimensions: (1) a multilevel system of beliefs, rules, and contestation between incumbents and challengers; (2) a level and pattern of energy or resource flows (e.g. how much electricity is consumed per capita); and (3) the material infrastructure that supports those flows and associated system beliefs (Geels, 2002; Schandl et al., 2009). This paper will focus on the first dimension, which we see as most important.

The purpose of the concept is to enable holistic analysis of production and consumption relations, in a manner that can detect asymmetric power relations and scrutinise their implications for the nexus policy agenda and its principles of increasing productivity and accelerating access of the poorest (Hoff, 2011). The concept synthesises insights from several social science perspectives, including policy

process analysis (May and Jochim, 2013); critical political economy (Akram-Lodhi, 2013; Wittneben et al., 2012; Hall et al., 2011; Jessop, 2010); sociological field theory (Fligstein and McAdam, 2011; Goldstone and Useem, 2012) and sociological approaches to consumption and production (Van Vliet et al., 2005; Reusswig, 2009; Shove, 2010).

To begin with, the concept of 'policy regime' sheds light on the discursive and institutional dimensions of a regime of provisioning. May and Jochim (2013: 429) define a policy regime as the governing arrangements for addressing a policy problem or issue. Those arrangements consist of a set of core ideas (i.e. discourses) that frame the issue in a particular way; institutional arrangements that channel attention and resources more or less effectively to dealing with the issue; and different interest groups which support or oppose the governing arrangements as they unfold over time. Regimes differ in institutional strength. The U.S. pollution abatement regime of the 1970s was a relatively strong regime involving a series of major policy reforms; by contrast, institutional responses in the U.S. to childhood obesity have been weaker and more scattered (Kersh, 2009; May and Jochim, 2013: 429).

From a sociological perspective, the way in which food, water, and energy are governed, produced, distributed, and consumed can be studied as distinct systems of provision (van Vliet et al., 2005; Reusswig, 2009; Shove, 2010). Systems of provision have a history and structure that reflect particular alignments of ideas and interests. In this paper, I use the term 'regime' of provisioning to underscore power asymmetries between incumbent and challengers within the regime (Hess, 2013, 2014).

Drawing on field theory (Ray, 1999; Fligstein and McAdam, 2011; Goldstone and Useem, 2012), we can further view a regime of provisioning as a 'strategic action field' composed of nested, smaller arenas (e.g. social movements embedded in a particular political culture and distribution of power). The regime, and each sub-arena within it, is a field of goal-oriented striving, in which players have a common understanding of the rules governing their struggle. At any given level, or considering the whole multilevel arena, the operation of the regime is neither smooth nor democratic, but more akin to 'institutional war' (Wittneben et al., 2012: 1436). Sharply defined patterns of inter-group domination as well as patterns of coalition may exist.

From a critical political economy perspective, several fundamental processes drive a regime of provisioning. First, the core logic in modern capitalist economic development is the attainment of a compound rate of economic growth. This requires that state and private sector continually invest in developing the physical infrastructure required to deliver growth in commodity output (Harvey, 2011: 86). For private sector actors involved in construction materials, civil engineering, power generation, urban water supply, and other infrastructure, such development would, ideally, also occur at a compound rate of growth. Second, as part of the design and implementation of major development or conservation projects, local elites and/or state agencies may physically dispossess people who are culturally or politically subordinate to them – a set of processes, referred to as 'dispossession through displacement', which may contribute to 'primitive [capital] accumulation' (Harvey, 2011; Akram-Lodhi, 2013). This perspective highlights the impact of enclosure on local livelihoods, excluding households from important sources of food and other resources (Hall et al., 2011).

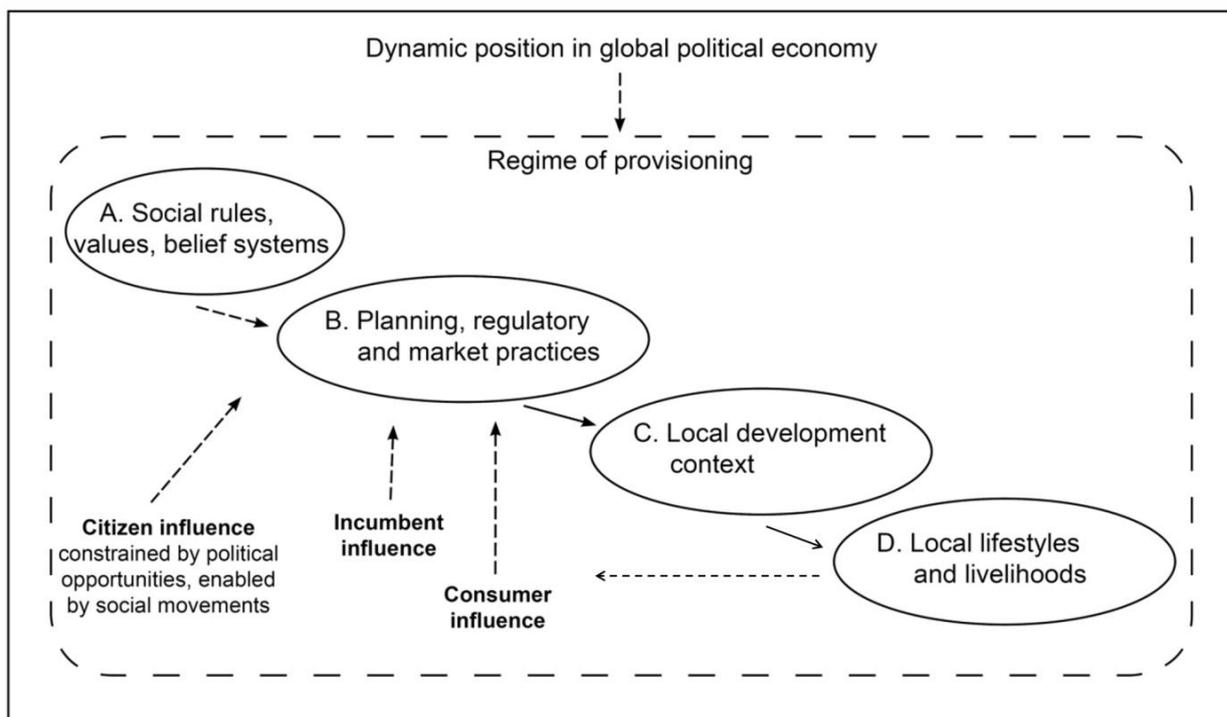
Third, farmers who produce and sell agricultural commodities are in a subordinate position to the market, and face 'dispossession by economic differentiation'. They face competition (from others: locally, regionally, or globally) and cannot dictate prices. Farmers can lower their costs through specialisation (e.g. monoculture production); investment in capital equipment and inputs to boost yields; and innovation (Akram-Lodhi, 2013: 34). These generic pathways however cannot guarantee competitiveness. Innovation (e.g. identifying niche markets, and entering into specific contracts) might confer temporary advantage. However, critical social science asks how capabilities to innovate can be distributed equitably, given prevailing capitalist market institutions. In short, facing the 'market imperative', smallholders who cannot find ways to lower their unit costs (through specialisation, investment, increased economies of scale, and associated innovations) will be unable to stay profitable

as emerging capitalist farmers, and face pressures to exit. Those able to invest in land, hired labour, and other inputs, or access innovations will accumulate at the expense of those who exit.

Figure 2 depicts a regime of provisioning. The figure focuses on some of the most important aspects discussed above. It emphasises the importance of sector-specific institutions, for example planning processes, regulatory principles, standards, and business models (Figure 2, B), which directly influence local development contexts (solid arrow). Examples at the middle, sector-specific level include urban planning processes, and the rate-based financial model for regulated energy organisations (where an organisation is allowed a particular rate of return on approved investments, such as power-generation stations). These specific practices and policy narratives in turn resonate with more widely-held, legitimising discourses within society (Figure 2, A), such as discourses about the need for economic growth and modernisation.<sup>7</sup>

In this perspective, the *nexus* is visualised as the superimposition of regimes: an aggregation of regulatory and planning practices in water, energy, and food regimes (cf. Figure 2) that may impose net costs on poor people, along with possible dispossessing impacts, in a possibly synergistic manner.

Figure 2. Regime of provisioning.



Source: adapted from Foran et al. (2014b).

Regimes have a considerable amount of structure and path-dependency. However, they evolve as forces from the global or national economy, as well as from society impact on them. They also evolve under the strategic influence of local business and political leaders, consumers and citizens. Challengers, for example consumer movements advocating for local government support of renewable energy, lobby against dominant actors (e.g. power utilities) to influence policy outcomes, such as rules

<sup>7</sup> In affluent societies individual privacy and convenience are highly valued, influencing the popularity of low-density settlements dominated by detached homes, and automobile transport (Filion, 2010).

permitting community choice aggregation<sup>8</sup> (Hess, 2013) (Figure 2, B). A variety of new institutional designs that support distributed solar energy have emerged, both for-profit and non-profit. However, well-resourced commercial actors (including new entrants, such as Google and venture-capital-backed firms) have dominated non-profit models in which local communities retain ownership of solar panels (Hess, 2013).

In this perspective, particular policy outcomes depend on the competition between various kinds of ideas (arguments, belief systems) as well as the ability to mobilise resources, and underlying material interests. The importance of material interests (e.g. the ownership of capital-intensive assets by electricity organisations) means that innovative ideas tend to be selectively appropriated and modified before they get incorporated into the prevailing regime of provision (Hess, 2013; Smith and Seyfang, 2013).<sup>9</sup>

Our interest in rules at multiple levels of a regime may remind some readers of Ostrom's Institutional Analysis and Design (IAD) (2007) framework. The IAD approach offers useful techniques to identify types of rules that contribute to producing a wide range of impacts we are interested in, ranging from costs of service provision to environmental and social impacts. Several differences should be noted. First, we conceive of regimes as essentially perpetually contested, as opposed to essentially rule-ordered or repetitive systems of behaviour. Second, we conceive of actors as complex: their positions (and occasionally interests) are malleable (McAdam et al., 2001). Positions and interests can change through persuasion and other discursive processes. Third, drawing on social movement studies, we are explicitly interested in strategies, repertoires, and dynamics of resistance to dominant rules (Tarrow, 2011; McAdam et al., 2001).

### **Regime constraints on critical system nodes**

Using the regime of provisioning as a lens, we revisit three of the critical system nodes proposed by Smajgl and Ward (2013a): Energy demand, fish stocks, and land use change and irrigation (Tables 2 and 3).

#### *Energy demand*

As alternatives to supplying electricity via hydropower, Smajgl and Ward (2013a) propose consumer choice, along with building and construction ordinances. In fact, conventional energy organisation business models, in line with fundamental beliefs, make revenues a direct function of energy sales or investment in assets such as power plants, poles, and wires (Figures 2, B). This means that significant investment in energy efficiency, such as notable and cost-effective appliance standards and labelling programmes in Thailand (Foran et al., 2010a), actually conflict with conventional business models by reducing the sales or returns of distribution and generation organisations (Foran et al., 2010a; CSIRO, 2013). In other contexts, regulatory rules and business models exist that reward investment in energy efficiency by electricity suppliers (Kushler et al., 2006; Palang Thai and A.W.I.S.H., 2009). However, they will not be adopted in the Mekong region without a significant struggle over the existing regime.

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<sup>8</sup> Aggregation of large numbers of customers in a geographic region into a contract with an energy services provider based on a negotiated price and energy mix (Hess, 2013).

<sup>9</sup> One conceptual framework used to explain change and continuity in large technical systems is the so-called multilevel perspective (MLP) which uses the concept of social-technical niches, regimes, and landscapes. Earlier work on this perspective has been criticised for managerial, depoliticised treatment of change, in part a function of the MLP's system-oriented, long-duration time scale. More recent contributors who use the MLP or related approaches (such as 'strategic niche management') recognise the importance of political contention (Hess, 2013). However for specific concepts related to political interaction between challengers and incumbents in a system of provisioning, we need to look beyond the MLP to political sociology (McAdam et al., 2001), specifically to social movement studies, and to field theory (Fligstein and McAdam, 2011; Hess, 2013; Smith and Seyfang, 2013).

Providing consumer choice (e.g. retail of 'green power') would likewise entail significant change to a sector dominated by monopoly generation and distribution organisations. Meanwhile, private-led hydropower development constitutes another arena within the energy regime that works against energy demand management. In the Mekong region, hydropower projects are developed in an entrepreneurial and exclusive process. Driven by developers and government agency sponsors, the process does not allow significant public discussion, or democratic veto, based on transparent and accurate understanding of benefits and costs (Foran et al., 2010b).

### *Fish stocks*

In order to sustain this critical resource,<sup>10</sup> Smajgl and Ward (2013a) recommend effective regional monitoring, and a governance system (presumably multilevel) for fishing and fish migration. In fact, ample evidence exists of locally sustainable, community-based management regimes (Arthur and Friend, 2011). On the other hand, governments have displayed little awareness of or interest in "applying the latest hydrological and ecological understandings of complex river systems to governance and management activities" (Sneddon and Fox, 2012: 287).

The absence of an effective multilevel fisheries management system reflects a particular regime of provisioning. The regime's dominant narrative states that open-access fishing, population increase, and economic development (including hydropower) spell the inevitable decline of capture fisheries. Aquaculture, and artificially stocked reservoir fisheries, can and should replace wild capture fisheries. Although each of these points can be rebutted (Friend et al., 2009), a long-standing, pro-aquaculture, coalition of interest exists between breeders, fisheries agency programming and budgets, and entrepreneurs (Bush, 2008; Ha and Bush, 2010; Hortle et al., 2011). Interest in aquaculture reflects the fact that wild-capture fisheries are more difficult to appropriate privately, because of their seasonality, mobility, and the presence of common property access rules (Arthur and Friend, 2011; Sneddon and Fox, 2012).

### *Land use change and irrigation*

State-sponsored agricultural development is occurring in diverse agroecological zones: expansion of rain-fed commercial crops, notably rubber and pulpwood, as well as expansion of irrigation schemes, notably in Northeast Thailand. Contributors to the Mekong nexus book expected major expansion in rubber cultivation would contribute to notable agrarian change in Lao PDR, Cambodia and Yunnan, degrading local water quality and flow regimes (Fullbrook, 2013; Bouapao, 2013). Large-scale diversions into Northeast Thailand for new irrigation schemes would require state financing. Commercial viability of dry-season rice or sugarcane might likewise require state subsidy (e.g. price supports) as well as supply of low-cost labour. Because such developments favour better-capitalised smallholders and agribusiness investors, they might not alleviate poverty. Consequently, Smajgl and Ward (2013a) recommended incentives to minimise extensive development of monocultures; investment to improve productivity of smallholders; and regulating foreign direct investment to protect existing tenure.

A regime of provisioning perspective would question how realistic it is to re-regulate investment practices, in specific settings such as Lao PDR and Cambodia, which have facilitated large-scale commercial plantations (Barney, 2012; Fullbrook, 2013). A regime perspective would also explore the history of various approaches to improving smallholder productivity, alert to outcomes such as dispossession through differentiation and tracing the adequacy of social welfare provisions. The viability of diversified smallholder agriculture needs to be assessed (Nhan et al., 2007; Tipraqsa et al.,

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<sup>10</sup> One reviewer noted that the word 'stock' frames fish almost exclusively in economic terms, ignoring their customary position within livelihood and ecological networks.

2007) particularly in places where it is ostensibly supported by the state, for example in Thailand under the principles of sufficiency economy.

### **SYNTHESIS AND CONCLUSION: THE NEXUS AS A CONTESTED POLICY AGENDA**

The conceptual development presented in this paper is a response to the emerging argument that critical system nodes exist (Smajgl and Ward, 2013a). To avoid unintended social and ecological outcomes, it is more pragmatic, so goes the argument, to manage the array of processes referred to as 'nodes', than to prevent large-scale developments, such as hydropower dams, from taking place (Smajgl and Ward, 2013a). The argument points to the possibility that failure to manage energy demand, to sustain wild-capture fisheries and associated livelihoods, and to provide equitable access to land, will lead to vicious feedback cycles that cross sectors. For example, in the Mekong region large-scale water diversion and hydropower could lead to out-migration of nonviable small farmers, leading in turn to increased energy demand in urban settlements. These are examples of socio-ecological challenges that a complex systems approach to the nexus seeks to avoid.

Based on a complex systems approach, the Mekong resource nexus has been conceived as a set of multiple, often bottom-up, ramifying connections between different development strategies. In this paper, I showed how a regime of provisioning approach provides another way to conceptualise the nexus: as the cumulative impact not just of development *projects*, but more fundamentally, as the consequences of energy, water, and food *regimes* of provisioning, from which such projects arise. This approach provides essential social structure and political context, in contrast to the rather depoliticised and ahistorical treatment of social order and context in the dominant energy-water-food nexus literature. From a critical social science perspective, the nexus can be visualised as the superimposition of regimes: for example, the aggregation of sector-specific regulatory and planning practices in water, energy, and food regimes (cf. Figure 2) that impose net costs on poor people, along with possible dispossessing impacts.

In this concluding section, I outline some elements of a new research agenda to guide inquiry and action on the resource nexus. The argument touches on powerful interests, the emergence of the resource nexus as a new agenda, the likelihood that small farmers and other marginalised actors will be initially disempowered by such agendas, and finally the contribution a regimes of provisioning perspective could make to empowering small farmers, rural workers, and those who advocate on their behalf. In order to make the argument as clear as possible, I present it as a set of linked propositions.<sup>11</sup>

Proposition 1: Public initiatives around the resource nexus are attempts to promote a new 'policy regime' (May and Jochim, 2013), built on a language which is relatively new, ambiguous, and contested. Concepts such as 'managing the nexus' and 'critical nodes' are reductive. However by virtue of their ambiguity and pluri-vocal nature, they enable different networks and coalitions to form or to consolidate (Hajer, 1995; Lejano et al., 2013).

Some of these coalitions will advocate for incremental ('ecological modernisation') reforms to resource-based industries. Other coalitions could conceivably use the nexus concept to advocate for more radical changes. However, the concept of regime of provisioning (Section 4) emphasises how prevailing discourses, practices, and institutions govern possibilities for change. If power-laden regimes of provisioning exist, this raises the question of how social movement organisations, community-based organisations, and other subordinate actors, through various forms of social mobilisation, challenge prevailing regimes (Missingham, 2003; Foran, 2006).

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<sup>11</sup> Based on a social process approach to explanation (see above) the propositions focus on defining causal powers and liabilities, rather than predicting particular outcomes.

Proposition 2: In order to safeguard their interests, social actors within a contested (adversarial) regime of provisioning make use of prevailing discourses, practices and institutional forms. They will use new, ambiguous, or contested discourses (such as 'managing the nexus') to further pre-established positions and interests (Weible, 2008). Subordinate actors, disadvantaged by their socioeconomic position in the regime, are less likely to find dominant nexus discourses accessible or salient.

Propositions 1 and 2 lead us to view the nexus as a political project that is unfolding and contested. Since little more than a core storyline and public donor funding exist at present, the emergence of any policy regime around the nexus will require a decadal-scale effort. In developing countries, the nexus agenda is unlikely to lead to socially inclusive development strategies, unless its concepts are linked to specific issues that local civil society actors find salient and legitimate. Proposition 2 implies that significant bridging work remains to be done between those who believe the conventional nexus agenda is sufficiently pro-poor, and their critics. More importantly, these propositions challenge us to imagine how regimes of provisioning food, water, and energy in the Mekong region – regimes that have long been adversarial, because their dynamics include dispossession of the poor – can be possibly made more inclusive. Collaborative governance is one possible approach (cf. Emerson et al., 2012). The Exploring Mekong Region Futures Project was a modest attempt at collaborative governance, albeit an elite-oriented one dominated by complex systems science. However, significant mobilisation, disruption, a hurting stalemate, and recognition of interdependence may be necessary before more collaboration emerges (Foran, 2006; Weible, 2008; Emerson et al., 2012).

Proposition 3: To mobilise subordinate actors around resource nexus issues, insights regarding power and inequality will be necessary. Such insights can be gained by analysing how historical, discursive and institutional elements in regimes of provisioning burden the poor in a specific region. Complex systems thinking can then be used to identify tentative, undesired feedback relations. The first statement in this proposition is based on observation of how the Assembly of the Poor, a social movement organisation, used social justice narratives and disruptive civil disobedience, to mobilize resistance to infrastructure development and displacement in Thailand (Missingham, 2003; Foran, 2006). The second statement sums up the interdisciplinary approach used in this paper to re-examine the Mekong resource nexus.

In conclusion, this paper presented an interdisciplinary analysis of the Mekong resource nexus. The analysis was based on four empirical examples: the Delphi process of the *Exploring Mekong Region Futures* project; and three of the 'critical system nodes' identified by Smajgl and Ward (2013a): energy demand, fish stocks, and land use change and irrigation. Three propositions synthesised recommendations for further research and inclusive practice.

If, as proposed by analysts using complex system thinking, important processes ('critical system nodes') exist across different sectors of natural resources development, their essential socio-political properties must be described. Such processes are always constructs of the analyst. Poorly characterised constructs impede analysis and possible reform recommendations. Our understanding of how 'nodes' are structured and governed may deepen if we approach the nexus as a superimposition of regimes of provisioning.

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