Political Borders, Epistemological Boundaries, and Contested Knowledges: Constructing Dams and Narratives in the Mekong River Basin

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Abstract: The Mekong River Basin of mainland Southeast Asia is confronting a series of intertwined social, political, and biophysical crises. The ongoing construction of major hydroelectric dams on the river’s main channel and tributary systems—particularly in the basin’s lower and more populated reaches—is leading to significant socioecological changes. Multiple scientific studies have suggested that proceeding with the planned dam construction will disrupt the region’s incredibly productive fisheries and threaten the livelihoods of millions of basin residents. These effects will almost certainly be exacerbated by global and regional climate change. Yet increased understanding of the adverse consequences of dams for the Mekong’s hydrological and ecological processes is having minimal impact on decision-making around hydropower development. While local communities, non-governmental organizations (NGOs), and certain scientists draw on this knowledge to oppose or question accelerated dam building, state officials and hydropower developers have turned to the expertise of engineering and technological assessments in order to justify dam construction. Drawing on work in political geography, political ecology, and science and technology studies (STS), we ask two primary questions. First, why does engineering/technological knowledge retain so much legitimacy and authority in the face of mounting scientific knowledge about ecological change? Secondly, how are narratives of progress deployed and co-produced in the contested epistemologies of large dams as development? We conclude with some examples of how contestations over dams seem to be shifting epistemological boundaries in meaningful ways, creating new spaces for knowledge production and transfer. To answer these questions, we focus on three contested dams that are at various stages of construction in the basin: the nearly complete Xayaburi Dam, the under-construction Don Sahong Dam, and the planned Pak Beng Dam. The research advances understandings of the politics of contested knowledges as they become manifest in the conceptualization and governance of large dams in transboundary basins.

Keywords: hydropower; Mekong River Basin; political ecology; STS; public knowledge controversies

1. Introduction

“The Don Sahong and other mainstream dams are foolhardy and dangerous, as they threaten to fundamentally change the nature of the river and its resources, which serves as the lifeblood for millions of people in the region.” Kumpin Aksorn, from the Thai community-based organization Hug Namkhong (https://www.internationalrivers.org/resources/continued-work-towards-the-don-sahong-dam-threatens-havoc-for-mekong-fisheries-8023 (retrieved on 31 July 2018))

“I visited (the dam). It does not have any impacts.”

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On 23 July 2018, the Xe-Pian Xe-Namnoy dam collapsed in southern Laos, sending 481 million cubic meters of water downstream. Thousands of people were left homeless in Laos and Cambodia. At least 27 people died, and more than 100 went missing. Livestock and crops were wiped out. The dam, which was built by a Korean engineering and construction firm, collapsed when water overtopped the structure following torrential rains. International Rivers, a non-governmental organization (NGO) that has long criticized dam building in the region, issued a statement saying that the dam was not designed to deal with extreme weather events, and that locals were never meaningfully consulted before construction commenced (https://www.internationalrivers.org/dam-collapse-in-laos-displaces-thousands-exposes-dam-safety-risks (retrieved on 3 August 2018)).

Ian Baird, a geographer with expertise on the impact of hydropower on fisheries in Laos, stated that the collapse was likely from “faulty construction or a decision to store too much water in the dam’s reservoir at a time when heavy rains should have been expected”, and that the companies were “trying to play this out as a natural disaster that wasn’t their fault”, which he did not “believe for one second” (https://www.nytimes.com/2018/07/26/world/asia/laos-dam-collapse.html (retrieved on 3 August 2018)).

This event underscores the crux of our inquiry into the Mekong Basin, where the ongoing and planned construction of major hydroelectric dams on the river’s main channel and tributary systems—particularly in the basin’s lower and more populated reaches—is significantly changing the system’s hydrology, fisheries production, and the livelihoods of millions of basin residents. Recent biophysical research has demonstrated that the present suite of dams on the river’s main channel (concentrated in the Mekong’s upper reaches in China) and tributaries has had significant downstream and cumulative effects on the basin’s water flows and sediment transport [1–4]. Environmental research has explored scenarios involving up to 12 major hydroelectric dams on the river’s mainstream and concluded these projects will have significant negative impacts on fish production, fish diversity, and food security in the region [5–11]. Recently published hydrologic models show likely significant negative effects on downstream socioecological systems such as floodplains in the Mekong’s lower reaches if dam construction proceeds as currently planned [12]. These effects will almost certainly be exacerbated by global and regional climate change [13].

Studies on the potential negative socioecological impacts of large dams, as well as questions about their economic benefit [14], have had little influence thus far on the plans of the region’s governments to proceed with hydropower development projects. The Lao government is currently building two large hydroelectric schemes—the Xayaburi and Don Sahong projects—on the Mekong mainstream, and has announced plans to construct a third, the Pak Beng Dam [15]. Given the sheer magnitude of fish production in the basin, the impacts of hydropower development on fish-based livelihoods will be significant—one study indicated a 26–42% reduction in the current two million metric ton annual production, should planned mainstream dams move forward [16]—and almost certainly negative. In the face of criticism from NGOs and academics regarding these projects’ likely deleterious impacts, government officials have argued that the dams will have minimal effects, and that displaced communities and negative environmental effects can be effectively mitigated. The Chinese government claims that the cascade of hydroelectric facilities in the upper Mekong will benefit water governance in the river’s lower reaches by augmenting dry season flows and exercising flood control during the wetter months. Yet officials in Yunnan province, where the dams are located, have been reluctant to release flow data that might reinforce these claims [17]. In a similar vein, Cambodian Prime Minister Hun Sen disparaged research that predicted that the Lower Se San II dam will negatively affect 70% of fish in the Cambodian part of the basin, asking “Do our country’s fish know how to climb trees? Do they know how to climb mountains?” [18]. His comments suggest that even nonsensical claims about
the lack of environmental consequences (that seemingly equate dams with other natural features on the landscape) can prevail over ecological assessments if promoted by powerful decision makers.

In nearly all cases of current and planned hydroelectric development in the Mekong—as well as in transboundary basins such as the Nile, Nu/Salween, and Amazon—project proponents and opponents alike muster technological, scientific, and locally-based knowledge claims to defend their positions vis-à-vis dam construction. The public knowledge controversies engendered by large dams underscore the primacy of the politics of knowledge production, circulation, and use. Crucial decisions regarding the siting, design, and operation of hydroelectric facilities throughout the basin ostensibly rely on state-of-the-art scientific understandings of the basin’s critical biophysical processes such as water flows, sediment transfer, and fisheries production. Yet, it remains unclear precisely how such knowledge is incorporated into water governance in the Mekong or other large transboundary basins. It is even less clear whether the myriad of types of knowledge produced at local sites throughout the basin, on occasion facilitated by Mekong River Commission (MRC)-sponsored experts, independent scientists, and non-governmental organizations (NGOs), are received and integrated into the decision-making around any given project.

These intertwined conceptual themes—knowledge, borders/boundaries, and technology—are at the core of our inquiry. We argue that interrogating political borders and epistemological barriers as they relate to knowledge production and knowledge flows is an important part of understanding the acceleration of large dam construction in a transboundary basin [see also the related conceptual notions in this special issue’s introductory article]. To facilitate our inquiry, we ask the following questions. Why does engineering/technological knowledge retain so much legitimacy and authority in the face of mounting scientific knowledge about ecological change? How are narratives of progress deployed and co-produced in the contested epistemologies of large dams as development? A key finding of our research is that technological and engineering knowledge, evolving in conjunction with narratives of development, inequitable power relations, and institutional arrangements, creates epistemological barriers that devalue or de-legitimize local and ecological knowledge. Our research relies on multiple documents focusing on the competing knowledge claims regarding disputed hydropower projects in the Mekong—including governmental and intergovernmental reports and websites, independent assessments of socioecological impacts from the scientific community, newspaper articles, and the statements of activist and NGO groups (both authors have over 20 years of research experience in the Mekong basin, and the analysis draws heavily on hundreds of documents and observations regarding the changes that have occurred during this period). We use constructionist discourse analysis to uncover how “particular lines of argument have become taken as truths, while others are dismissed” [21]. Our perspective is informed by critical theory as well as interpretive policy analysis [22], which means that we are investigating dominant assumptions about society–nature relations, exposing how promotional and oppositional communities form around particular policy issues (e.g., hydropower development), and ultimately gaining a more robust understanding of the social and ecological implications of mainstream, hegemonic definitions of development. Our inquiry draws primarily on developments in the region beginning in 2010, when the Lao government submitted prior consultation documents to the Mekong River Commission. In the same year, the International Centre for Environmental Management submitted a report on mainstream dams, which recommended a 10-year deferment on mainstream dam building [23].

We begin the paper by explaining two crucial levels at which borders and boundaries shape and regulate knowledge flows in transnational river basins. The first level, which is familiar to scholars of political geography, is constituted by the socially constructed yet potent political borders that separate national territories and define a river system as transboundary. The second boundary, which is familiar to science and technology studies (STS) scholars and political ecologists, is constituted by the epistemic barriers that divide different types of ‘expert’ knowledge (e.g., engineering, technical knowledge, and scientific knowledge) and multiple types of ‘non-expert’ knowledge, which are often manifest through cultural and linguistic differences. Both types of borders figure prominently in public
knowledge controversies surrounding economic development, and particularly the construction of large dams. We use these understandings of borders and boundaries to focus our questions around the Xayaburi, Don Sahong, and Pak Beng dams. An overarching goal is to reveal the power relations that underpin the knowledge claims that have been put forward by multiple actors, and better understand how those claims are shaping the development and governance in this transboundary basin. Addressing these questions allows for more informed explanations about how conflicts over dams might be shifting epistemological boundaries and creating new spaces for knowledge production and transfer.

2. Borders, Boundaries, and Knowledge Controversies

2.1. Constructing Borders

In the Mekong River Basin, contestations over knowledge surrounding hydropower development are heightened by the transboundary nature of the river, which flows for 4800 km from the Tibetan Plateau in China through Myanmar, Laos, Thailand, Cambodia, and Vietnam (see Figure 1). Water, sediment, and migratory fish pay no heed to the political lines on a map of the region, but basin boundaries define the geopolitical relations that shape knowledge flows and hence basin governance [24]. Although the complexity of the political landscape is not reflected fully by the map of sovereign states, borders can enclose projects, demarcate domains of development, and obstruct the flow of environmental knowledge in the Mekong, while also explaining which knowledge is promoted. Mekong development depends on states pursuing their sovereign right to harness the river within their borders [25], but development also benefits from the narrative of a region of “traversed boundaries” [14], whereby electricity can flow freely from Laos to Thailand, or state-focused knowledge can be channeled through the multilateral MRC to align with “sustainable development” agreements (the Mekong River Commission comprises Lao PDR, Vietnam, Cambodia, and Thailand) [26].

Our investigation into the relationship between hydro development, contested knowledge, and sovereign states builds on work in political geography and critical geopolitics that understands borders as co-produced through contingent political, economic, and technological processes [27,28]. We also derive insights from STS scholarship, which reveals the “messy, impure, and political” nature of science [29], and which explores how scientific knowledge evolves in conjunction with representations, institutions, and identities [30,31], thereby helping to give meaning to technological objects such as large dams. Together, these frameworks shed light on processes of “border work” [32] occurring in the region, whereby borders, technological and engineering knowledge, and hydropower projects are co-produced. In other words, states have development agendas, and they have the sovereign right to define and carry out development within their borders. Dams, as material expressions of development, depend on the state embracing and elevating the technological and engineering knowledge that underpins their construction and operation. Backed by powerful state and corporate interests, this knowledge gains legitimacy as expertise shaping the development of natural resources. Once built, dams help ensure that the relationship between hydropower and development becomes even more tightly interwoven in state discourses and policies. In countries such as Laos, where there is little opportunity for opposition to these agendas, the space for pursuing alternative development paths becomes increasingly narrow.
This ‘problem’ is framed “in terms that are amenable to technical solutions” such as large dams [34]. Threats to wild-capture fisheries and the livelihoods that depend on them become less important than a lack of electricity to power development. Furthermore, when fisheries are degraded, engineering and technical solutions are understood as adequate to address the damage. As knowledge claims and state interests adapt to one another in a process of mutual development [28], the river is transformed in ways that invite further state control and more ‘expert’ engineering knowledge, while simultaneously rendering the river ecosystem less intelligible to local communities and their traditional knowledges. In this way, the co-production of borders is closely linked to the epistemological boundaries that characterize the landscape of contested knowledge in the basin.

Figure 1. Map of Mekong River basin showing existing dams and ongoing hydropower projects mentioned in the article.

These dynamics are at play in the cases of the Xayaburi, Don Sahong, and Pak Beng dams. The Lao government sees the energy sector (primarily hydropower) as the means to elevate itself to middle-income status and increase its political–economic influence in the region [33]. The Ministry of Energy and Mines, which is the implementing ministry for hydropower projects, notes that “the power sector has been classified as a development strategy of the national economy”, and that the sector “has the potential to play a pivotal role in achieving the social and economic development objectives” (http://www.poweringprogress.org/power-sector (retrieved on 3 August 2018)). To support this narrative, the state relies on a process that has been termed “rendering technical”—a set of practices concerned with defining boundaries, assembling information, and representing “the domain to be governed as an intelligible field with specifiable limits and particular characteristics” [34]. In this case, the river becomes intelligible to the state primarily as an underutilized resource. This ‘problem’ is framed “in terms that are amenable to technical solutions” such as large dams [34]. Threats to wild-capture fisheries and the livelihoods that depend on them become less important than a lack of electricity to power development. Furthermore, when fisheries are degraded, engineering and
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2.2. Maintaining and Challenging Epistemological Boundaries

While state actors are potent forces in knowledge controversies in the Mekong region, a growing network of non-state actors are deeply implicated in the transformation of the river and are increasingly important nodes of knowledge production and transfer [24,35–37]. Non-state actors in the region include multinational corporations, local communities, NGOs, multilateral organizations, scientists, and academics. Woven throughout the relationship between these actors and hydropower development are epistemological boundaries, which become apparent when what is perceived by powerful actors as legitimate knowledge (often associated with technology and engineering knowledge) confronts other forms of knowledge (often lay or local knowledge, but in this case also knowledge produced by ecologists and social scientists). Building on STS scholarship that examines complex environmental debates [38–41], political ecologists have expanded research on the epistemic boundaries between expert and non-expert knowledge, emphasizing how the production and circulation of environmental knowledge regarding particular socioecological interventions (e.g., development projects) are contingent on the power relations of particular places and tend to serve the interests of those who stand to benefit economically and politically from those interventions. Moreover, in the case of Mekong hydro development, it is clear that boundaries exist between different types of expert knowledge. For example, a key boundary lies between the engineering and technological knowledge produced by consultants, states, and hydropower companies, and the knowledge produced and supported by ecologists and social scientists. We make a distinction between these two types of expert knowledge, without claiming that one is inherently more legitimate than the other. Rather, we emphasize how engineering and technical knowledge is elevated by powerful political and economic interests to serve a particular development agenda associated with hydropower in the present moment. For example, this knowledge could just as easily drive a solar power revolution in the basin in the future, with a different set of environmental and social outcomes. Engineering and hydropower technologies are associated with types of expert knowledge that are typically inaccessible to the public and therefore often generate strong boundaries. We contrast this with ecological science, which is also a type of expert knowledge, but one that is often aligned with how locally based, resource-dependent people are experiencing changing Mekong ecosystems. While no knowledge claims are free from biases and agendas [42], and the boundaries among multiple types of expert knowledge are blurred in multiple ways, the distinction between different expert knowledges is critically important in understanding dam building decisions and the subsequent conflicts in the region.

Political ecology has been particularly effective in highlighting the ‘non-expert’ side of the epistemic boundary, because it focuses on how “local”, “traditional ecological”, “indigenous”, “experiential” or “tacit” knowledge has been used to both counter and abet scientific knowledge in the context of international development and conservation [43]. Years of academic research in the Mekong system have highlighted the value of local knowledge in terms of generating crucial knowledge regarding fish production and migration [44,45]. While place-based knowledge claims regarding human–environment relations are often a welcome palliative to environmental narratives of states and other powerful development actors, local knowledge systems should not be perceived as a universal panacea for environment development dilemmas. Such knowledge is neither foolproof nor immune from a variety of social influences that challenge its veracity and its uses [46]. Evidence suggests that integrating scientific and local forms of knowledge produces hybrid knowledges that present robust, practical insights on how to ameliorate environmental degradation
and livelihood vulnerabilities [47,48]. Yet, the awareness and implementation of hybrid or co-produced knowledge in Mekong water governance arrangements remain uncommon.

Scholarship on the boundaries between different types of knowledge can be fruitfully integrated and extended by focusing on what have been termed public knowledge controversies [19]. Such controversies regarding how to best resolve environmental problems might involve a variety of conflict points, including disagreements about: evidence, interpretations of evidence, the nature of expertise, the relative transparency of expertise, or the level of participation of non-experts [19]. When these disputes involve transnational environments and networks of actors (e.g., oil pipelines, international river basins), the issues driving the controversy can remain unresolved for years; they also tend to engage a diversity of interested parties beyond research scientists (e.g., government agencies, corporations, non-governmental organizations, and media outlets), and often mobilize transnational norms of governance (which are often unavailable at national levels) that provide a template around which different actors can support or resist knowledge claims [49]. These conflicts also raise important questions regarding how expertise might be democratized to consider and assess a variety of knowledge domains, particularly ones that stand apart from formal sites of knowledge production in the academy or other professional arenas [50].

Large dams are exemplars of public/transnational knowledge controversies, and existing and future hydroelectric projects on the Mekong’s mainstream and its tributaries can be used to rethink the role of political and epistemic borders in shaping the flows of environmental knowledge in transnational river basins. Current hydropolitics in the Mekong basin are dominated by interstate tensions regarding the potential downstream impacts of dams built or underway in China and Laos on critical downstream environments in Cambodia (particularly the productive fisheries of the Tonle Sap region) and the Mekong Delta region of Vietnam [51]. With regard to mainstream dams in Laos, the Chinese government is fully supportive, since a highly regulated Mekong River is aligned with its development vision for the basin. The Thai government is mostly supportive, since it will be a primary consumer of the power generated by the projects. Cambodian and Vietnamese officials have voiced some opposition due to the downstream impacts, but both support the sovereign right of countries to develop the river for national development. At another level, dam projects—past and present—have been criticized by an assortment of local, national, regional, and global scientists and advocacy organizations who insist that government assessments of their likely socioecological impacts have been inadequately scrutinized and rely on tentative and incomplete scientific understandings of the flow dynamics of large rivers, fish ecology, and other biophysical processes [52]. A crucial part of these critiques is that government-sponsored impact assessments almost never account for the local knowledge of observed effects of river alterations, which is generated by the communities that are most affected by the dam projects in the region. Thus, a focus on conflicts regarding large dams in the Mekong basin will shed light on how borders at political and epistemological levels feed into knowledge controversies and affect knowledge flows throughout the basin.

3. Supporting Hydropower through Technical and Engineering-Based Knowledge

The Xayaburi, Don Sahong, and Pak Beng dams are the first three of 11–12 dams planned for the mainstream in the lower basin. Xayaburi is nearly complete, Don Sahong is in the early stages of construction, and Pak Beng is still in the planning phase. Each dam has been characterized by controversy, and all three are situated on the river within Lao territory. Construction of the 1285-megawatt Xayaburi dam in northern Laos began in 2010. With financing coming from six Thai commercial banks, the $3.2 billion project is being built by Xayaburi Power Company Limited (XPCL), which is a subsidiary of the Thai construction company CH Karnchang Public Company Limited. Thailand’s electricity utility, the Electricity Generating Authority of Thailand (EGAT), has agreed to purchase 95% of the dam’s electricity. Laos and dam developers have made the case that Xayaburi is a run-of-river project, but critics dispute that characterization, given that dam retains water for up to two days. Key concerns include the dam’s effect on migratory fish, downstream ecological
impacts, the relocation of more than 2000 people from the site, and negative consequences for the livelihoods of more than 200,000 people living near the dam [53,54]. Construction of the 25-meter-high Don Sahong Dam, which is located in southern Laos a few kilometers from the border with Cambodia, began in early 2016. It is expected to generate 260 MW of electricity for domestic use and export to Cambodia or Thailand. The project’s developer, Don Sahong Power Company, is a joint venture between the Government of Laos and Mega First Corporation Berhad (MFCB), which is a Malaysian company. The company will build, operate, and transfer the project over a period of 25 years. A crucial worry is that the dam will irreparably harm both commercial and subsistence fisheries, because it will block the Hou Sahong channel, which is of critical importance for year-round fish migration [25,55]. The developers of both Xayaburi and Don Sahong have proposed engineering-based mitigations to address fishery concerns. The Pak Beng Dam would be the northernmost of the dams proposed for construction on the lower Mekong River mainstream. Datang (Lao) Pak Beng Hydropower Company is the project developer (with Thai and Chinese partners), and 90% of the energy produced by the 912-MW project will be sold to Thailand. The remaining 10% will go to Laos’ state-owned utility, Électricité du Laos [56]. The dam will displace 25 villages in Laos and two villages in Thailand. There is concern and controversy over the potential ecological and social impacts both at the dam site and downstream [57].

Over the past century, states have largely controlled the generation and sharing of environmental data, making the environment legible to the logics of economic growth and national security [58]. The development of natural resources is an important articulation of sovereignty, reflecting states’ desires to improve the condition of their populations [34]. To support these efforts, states, development banks, and their corporate partners produce and promote specific narratives about the sustainable development of resources [59]. Hydropower is assumed to be sustainable, with “sustainable hydropower” generally being used to describe all of the projects. This is reflected in documents such as the Lao government’s 2015 Policy on Sustainable Hydropower Development (which actually represents a lowering of human rights and environmental standards in hydropower projects) (https://www.internationalrivers.org/blogs/294/new-policy-proposed-on-hydropower-development-in-lao-pdr-puts-developers-interests-first (retrieved on 3 August 2018)). Similarly, in response to critiques of the Xayaburi Dam design, the Lao government insisted that the project “is a green energy and shall be strongly promoted and supported” (comments by Lao PDR on the MRC’s Technical Review Report of the Proposed Xayaburi Dam Project (retrieved on 4 August 2018 from http://www.mrcmekong.org/topics/pn pca-prior-consultation/xayaburi-hydropower-project-prior-consultation-process/). Hydropower is seen by government officials as being easily aligned with “a clear definition of sustainability”, with the challenge mostly being to get the policies and technical guidelines right (https://www.ifc.org/wps/wcm/connect/news_ext_content/ifc_external_corporate_site/news+and+events/news/new+hydro+policy+puts+focus+on+sustainability+in+lao+pdr (retrieved on 4 August 2018)).

While it is not surprising that a government would uncritically support its own policies and projects, it is noteworthy that these narratives prevail in the face of so much evidence to the contrary. Explaining their dominance requires unpacking how the engineering and technological knowledge that is necessary to promote and build large-scale hydro projects is evolving in conjunction with representations of the river, discourses about national identity, institutions for “sustainable development”, and narratives of mitigation and limited harm. The policies that emerge from this dynamic create space for certain types of knowledge, and that knowledge, in turn, supports and justifies policy, providing a clear example of co-production.

In the Mekong Basin, an influential array of actors—including construction and electricity companies, international consultants, engineering firms, government ministries, and multilateral organizations—come together to create a world of experts and expertise that generates and promotes knowledge aligned with technological and engineering views of natural resources. This world is
circumscribed by epistemological boundaries that are not easily penetrated by outsiders. The river is portrayed as an ecosystem that can sustain large dams, particularly when, according to the project developer for Xayaburi, they are “appropriately designed using the best available technologies”. This narrative extends to mitigation, which depends on engineering-based interventions, such as “fish-friendly turbines” (http://www.xayaburi.com/Environment_SG_eng.aspx (retrieved on 5 August 2018)). Uncertainty about the long-term, cumulative impacts and failure to investigate impacts beyond political borders further support technological and engineering-based knowledges, while institutional arrangements privilege state-based knowledge and suppress other understandings.

In the case of the Xayaburi dam, expert technological and engineering knowledge has been invoked throughout the contentious design and construction process. In 2010, the Lao government informed the Mekong River Commission of its intention to move forward with the Xayaburi dam, as required by the Procedures for Notification, Prior Consultation, and Agreement (http://www.mrcmekong.org/home/SearchForm?Search=xayaburi&action_results=%C2%A0%C2%A0%C2%A0%C2%A0 (retrieved on 5 August 2018)). Since Xayaburi is the first dam being built on the mainstream in the lower basin, its construction marks the first time that a member country has had to seek approval by the region’s government (which the MRC calls “prior consultation”), although there is no enforcement mechanism to actually stop a country from proceeding with a project [53,60]. Non-state actors have no official say, but they can provide comments. The MRC found that the design was inadequate, violating the MRC’s design guidelines for mainstream dams [61].

The Lao government subsequently hired a Finnish engineering company, Pöyry Energy, to review the Xayaburi Dam’s compliance with MRC requirements for mainstream dams. Pöyry, which styles itself as “the global thought leader in engineering balanced sustainability for a complex world” [62], recommended that dam construction continue, with additional environmental studies, the installation of additional fish ladders, and other technical design modifications to improve fish passage and sediment and nutrient issues.

In addition to concerns about conflict of interest (Pöyry is a business partner with the Thai company building the dam, and it was hired to do engineering work on Xayaburi after completing the report), the company’s recommendations raise many questions. For example, Pöyry acknowledged a lack of baseline data, but claimed that any baseline studies can be conducted and mitigation measures can be designed after construction on the dam is already underway [63]. The report stated that Xayaburi’s “fish-friendly turbines,” fish ladders, and locks can protect at least 28 species of fish, but research shows there are at least 139 fish species that would be blocked from swimming past the dam [64]. Moreover, scientific evidence from fisheries experts around the world suggests that no technology currently exists that would mitigate the impact of mainstream dams on Mekong fisheries [63]. None of these concerns are reflected in the discussion of environmental safeguards on the official Xayaburi website, where the company, Xayaburi Power Company Limited (XPCL), reassuringly wrote about the “thorough environmental and social impact assessment conducted by leading experts with extensive experience in environmental engineering” (http://www.xayaburi.com/Environment_SG_eng.aspx (retrieved on 5 August 2018)). Revealingly, the discussion of safeguards continued with the acknowledgement of consultation and feedback from the MRC, but this stated only that Lao PDR met its legal requirements regarding social and environmental safeguards.

Shortly after the Lao government began the prior consultation process, a major report on the environmental and social impacts of mainstream Mekong dams was released. The Strategic Environment Assessment (SEA) report, which was commissioned by the MRC, recommended that decision-making on mainstream dams (including Xayaburi), be deferred for 10 years due to the massive risks and impacts associated with the projects. Findings included significant negative impacts on fisheries and agriculture, growing inequality, increased poverty among fishers and riparian communities, the degradation of longitudinal connectivity, and limited opportunities to mitigate these damages [16]. While both Cambodia and Vietnam argued for further studies, particularly of the transboundary environmental and social impact, Laos rejected the recommendation, demonstrating
how political borders can reinforce epistemological barriers in a knowledge controversy. Notably, Pöyry also concluded that it was not the responsibility of the project developer to assess transboundary impacts in its response to MRC concerns [63].

A similar process of co-production involving political borders, expert engineering knowledge, mitigation strategies, and multinational capital is playing out in the construction of the Don Sahong dam in southern Laos. In this stretch of the river, which is characterized by complex channels, small islands, and enormous biodiversity, there is widespread agreement among ecologists and communities that the dam will have devastating consequences for fisheries [55,65]. The dam is being built on the Hou Sahong Channel, which is the largest and most accessible channel in the Siphandone area, and allows for year-round fish migration for more than 100 species. The dam also threatens the survival of the endangered Irrawaddy Dolphins, whose habitat is located immediately downstream. The dam, being built by Mega First Corporation Berhad of Malaysia and Sino-hydro (a State-owned Chinese company), is called a run-of-river scheme by the developers, but it will create a head-pond inundating about 308 acres of land between the islands of Don Sahong and Don Sadam. (Research on the ecohydrological impacts of so-called run-of-river dams, which are presumed by hydropower advocates to exert much less influence on river functioning than large storage dams, is still nascent. Recent work argues that run-of-river dams are likely to have significant and comparable impacts on river systems compared to those of large storage dams [66]. Most of the 260 MW that is generated by the project will go to Thailand and Cambodia. Even though Don Sahong is just a few kilometers from the Cambodian border, there have been no studies on its potential transboundary impacts. Don Sahong Power Company noted that “the project has clearly demonstrated in the Environmental Impact Assessment (EIA) and in several of the engineering studies there will not be any downstream transboundary impacts on regional sediment transport, water flow, or water quality” (http://dshpp.com/faq/ (retrieved on 4 August 2018)). Moreover, the Lao government claimed that Don Sahong is a tributary dam, and therefore not one that requires agreement by all of the MRC partners [67].

The premise that engineering interventions can mitigate ecological harm is even more apparent in the case of Don Sahong than Xayaburi. The developers propose to mitigate the loss of the Hou Sahong Channel for fish migration by re-engineering nearby Hou Xang Phuek and Hou Sadam channels. The plan is to widen and deepen those channels to enable fish passage. There is no evidence that this will work [55]. According to fisheries biologist Eric Baran, “Mitigation, if any, of the effects on fish migrations in the most intensive freshwater fishery in the world lies in the hands of consultants working for (dam management company Don Sahong Power Company (DSPC), without any control or oversight by any institution nor scientific organization” [67]. Despite these concerns, the DSPC remains optimistic about success, stating that they have “every confidence that natural channels can be improved to allow fish passage. We have initially targeted two specific channels, but there are more than 30 channels which could be modified” (http://dshpp.com/faq/ (retrieved on 4 August 2018)).

The situation with the Pak Beng hydropower project, which is currently undergoing prior consultation, is similar to what has happened in the cases of Xayaburi and Don Sahong. Pak Beng is proposed on the Mekong mainstream in northern Laos, which is upstream from the Xayaburi dam site. It is a run-of-river project with capacity of 912 MW. It will likely to lead to declines in the abundance and diversity of fish species, as well as “seriously and negatively” impact the Giant Mekong Catfish, including “eventually or possibly leading to extinction” [56]. Upstream and downstream fish passage mitigation measures are “untested and inadequate”, and baseline data are seriously lacking [57].

These dam projects reveal, in contrast to a more precautionary principle advocated by scientific studies such as the Strategic Environmental Assessment on Mekong mainstream dams, how engineering and technical knowledge focused on the dam itself is privileged when it comes to future uncertainty. Epistemological boundaries are drawn around the science and practice of mitigation as a type of expert knowledge, with few effective opportunities to contest the assertions put forward by consultants, power companies, and governments. Mitigation science is increasingly used to
de-politicize and normalize controversial infrastructure decisions. This results in the legitimization of certain types of knowledge, such as that which goes into “designing river flows” through hydropower projects [68], leaving less space for knowledge about a free-flowing river and the services that it provides.

4. Encountering Boundaries—Contested Epistemologies of Large Dams as Development

More than 157 new plant and animal species were discovered in the Mekong River Basin in 2017 which is both a testament to the region’s incredible biological diversity and further evidence of the uncertainty surrounding the impact of large dams on the river ecosystem [69]. The richness of the basin’s heterogeneous and overlapping ecological systems sustains the livelihoods and cultures of tens of millions of people. Based on their lived experiences of changes to the ecosystem from recent hydropower projects, communities along the river have repeatedly expressed concerns that align with the assessments of scientists such as Dr. Lilliana Corredor, who testified that hydropower development is “actually increasing poverty and despair, instead of ‘improving the standard of living and decreasing poverty’ as advertised; is displacing tens of thousands of people in poor communities from their homes, lands, and cultural sites, while offering a dismal compensation, which does not support the people to cultivate food or to fish” (http://www.mrcmekong.org/assets/Other-Documents/stakeholder-submissions/Open-Letter-to-the-Mekong-River-Commission.pdf (retrieved on 4 August 2018)). A 2013 study by the Inland Fisheries Research and Development Institute (IFReDI) found that changes in the availability of fish and aquatic resources in Cambodia are likely to have major negative impacts in terms of nutrition, income, and social equity. Replacement measures (e.g., livestock and aquaculture) would only partially compensate for the loss of wild fisheries, and would likely be more expensive, and less accessible to the poor (http://ifredi-cambodia.org/research-projects/ (retrieved on 4 August 2018)).

Similarly, a recent statement signed by community members along the river noted: “We have witnessed and experienced the destruction caused by the dams. For us, who live by the river and experience every change in the water systems, there is no question that such dams result in serious negative impacts for present and future generations, and should not be built” (https://globaljusticeecology.org/support-to-the-statement-by-local-people-on-dams-in-the-mekong-region/). Already, upstream dams in China have caused riverbank erosion, the loss of riverbank gardens, and unpredictable flows. Communities have directly experienced the loss of fish species with tributary dams such as the Pak Mun Dam in Thailand (www.livingriversiam.org/index-eng.html (retrieved on 4 August 2018)). At the site of the Xayaburi dam, which was a formerly “self-sufficient community that generated revenues via gold panning and cultivated their own riverbank gardens to produce rice, fruits, and vegetables, villagers are now finding themselves without jobs, very little money, and not enough food” (http://www.ipsnews.net/2013/06/dams-threaten-mekong-basin-food-supply/ (retrieved on 5 August 2018)). In Cambodia, upstream of a dam on the Sesan River, “fishermen waited in vain for the yearly migration in May and June. No more fish to catch. The villagers have moved elsewhere, escaping the rising water and increasing poverty. The only reminder of a once lively Kbal Romeas is the roof of a pagoda that seems to float on the empty water” (http://www.ipsnews.net/2017/11/meuk-dammed-die/ (retrieved on 5 August 2018)). Yet, the scientific and local knowledge that underpins these experiences and perspectives has had very little influence to date on the decision-making processes around the Xayaburi, Don Sahong, and Pak Beng dams.

As scholarship in STS and political ecology has long argued, the privileging of certain kinds of knowledge over others does not automatically inhere to the way that knowledge is produced. Rather, the situation results from a process whereby technological and engineering knowledge, evolving in conjunction with narratives of development, inequitable power relations, and institutional arrangements, creates epistemological barriers that devalue or de-legitimize local and ecological knowledge. The ability to envision and presumably create a better future
(i.e., “sustainable development”), offers a powerful rationale for privileging the knowledge and expertise that support such a path, while simultaneously dismissing other visions of sustainable livelihoods as outside the bounds of “expert” knowledge. This, coupled with extremely limited institutional opportunities to contest hydro projects through formal channels, marginalizes certain types of knowledge.

All three dams demonstrate the high value that is placed on a model of development that begins with energy production. The Lao Ministry of Energy and Mines is the primary governmental representative to the MRC, and it promotes the narrative of hydropower as the only feasible means to achieve development. The Ministry explains that the “development of electric power facilities a highly appropriate method of achieving sustainable social and economic development through an electrification program as well as a source of income” (http://www.poweringprogress.org/new/2-uncategorised/3-hydropower-in-lao-pdr (retrieved on 5 August 2018)). The Ministry describes hydropower as a low-cost and optimal use of the country’s resources that is driven by the logic that “we are going to build infrastructure because we are poor” [70]. It is often said that hydropower has the potential to turn Laos into the “Battery of Southeast Asia”, and the government hopes to have 12,000 MW in operation by 2020, with two-thirds for export (https://uk.reuters.com/article/laos-energy-minister/interview-laos-hydropower-generation-capacity-to-jump-almost-four-fold-by-2020-idUKK4N0SL0EG20141028 (retrieved on 5 August 2018)). Profits from exports are intended to fight poverty, and there is a clear sense that there is no real alternative. As Hun Sen, Prime Minister of Cambodia noted in response to criticism of the impacts of large dams: “How else can we develop?” (http://www.ipsnews.net/2017/11/mekong-dammed-die/ (retrieved on 5 August 2018)). These sorts of narratives create epistemological boundaries that exclude alternative scenarios.

Yet there are other visions of development for the region, which do not depend on “gambling with our future” (https://savethemekong.org (retrieved on 5 August 2018)). Instead, they prioritize livelihoods and the sustainability of ecosystems, as opposed to moving forward with “ecological time bombs” that could threaten the food security of 60 million people [71]. These scenarios are not based on romanticized views of subsistence livelihoods. Rather, they are models of development that would prioritize protecting Lower Mekong fisheries, which, according to recent estimates, are valued at $17 billion a year, contributing 3% to the combined gross domestic product (GDP) of Vietnam, Cambodia, Laos, and Thailand” [72]. The productivity of fisheries is deeply linked to local knowledge and communities’ connection to and interdependence with the river, and there is a need to take seriously the claims of locals who assert, “What we want is our village, our river. The river and forest are not for sale, and especially not our identity and dignity” [70]. In a document titled “Mekong Governments: Listen to the People!”, a host of local community organizations and individuals made a similar claim, writing that dams “have resulted in severe changes in the Mekong’s ecosystems, endangering life, livelihoods, and the economy of the entire region. Indigenous peoples, women, and children are most affected by these changes. The dams have also worsened the impacts of climate change that we are already facing” (https://globaljusticeecology.org/support-to-the-statement-by-local-people-on-dams-in-the-mekong-region/ (retrieved on 5 August 2018)).

These knowledge claims about the relationship between fisheries, development, and hydropower are increasingly supported by academic assessments, which make clear the tenuous link between large dams and development. For example, drawing on statistical and comparative evidence, and “reference class forecasting”, researchers found that the economic, social, and environmental costs of large-scale hydropower megaprojects consistently outweigh the benefits [73]. Their findings suggest that not only is there no evidence that large dams create the sort of development that Laos and other governments are hoping for, but they often actually have negative economic impacts. In light of such findings, the authors suggested that countries should pursue more “agile energy alternatives” [73]. These conclusions have been supported by other research that shows that the overall economic impact of Mekong dams would be negative, due to the devastation of wild-capture
fisheries [74]. Similar findings of economic, social, and environmental costs outstripping benefits have emerged from assessments of large dams such as Belo Monte in Brazil [75].

Furthermore, while there is clearly a need for energy, there are many options that would not devastate fisheries and livelihoods. Plans exist for alternative power sources, such as Thailand’s Alternative Energy Development Plan, which laid out a path for the government to work at small-scale renewable energy efforts such as biomass and solar, which would have local investment and work with local populations (http://www.unescap.org/sites/default/files/MoE%20%20AE%20policies.pdf (retrieved on 4 August 2018)). Recent research from the US-based Stimson Center details the promising potential for solar power in the Mekong region. Researchers predict that solar will be available in the next few years at six cents a kilowatt hour, making some of the most-damming dams unnecessary, since many planned Mekong dams would generate power costing eight or nine cents per unit. This would take place in conjunction with improvements to the current grid transmissions and a rethinking of regional power trade, allowing for overall “less-damming power infrastructure” [76,77]. Currently, the grid is in such bad shape in Laos that, according to the World Bank, in some places over 20% of the energy supply is lost during distribution (http://www.worldbank.org/en/news/press-release/2015/06/23/lao-pdr-to-improve-electricity-network-with-world-bank-support (retrieved on 4 August 2018)). This makes the devastation of fisheries and livelihoods even more questionable, as they are traded off for large losses of energy. People in the Mekong region clearly want to escape poverty and improve their lives. They have “aspirations for development and modernity” [78], but these aspirations and linkages to national economic development visions vary widely across the region given its ethnic, cultural, linguistic, socioeconomic, and political diversity. Moreover, there is little evidence that the individuals and communities that have been confronted with dams that affect their livelihoods in a myriad of ways accept coercion as a method of promoting a state-determined version of that development, particularly one that places disproportionately high costs on resource dependent communities.

5. Conclusions—New Spaces for Knowledge Production and Transfer?

In December 2017, China announced that it would not proceed with plans to blast islets in the Mekong River near Chiang Rai, Thailand because the project to alter the channel for navigation would harm nearby Thai communities. While this project does not match the scale of a mainstream dam, the blasting plans were vigorously opposed by NGOs, communities, civil society, and scientists [79]. It is notable not only that China is halting the detonations, but that it did so in response to the activities of a coalition of activists (albeit, supported by the Thai state). Furthermore, the opposition was based on local knowledge emerging from experiences with upstream dams in China. As dams were being built in China over the past 20 years, communities began to notice unusual fluctuations in water levels. One consequence was the destruction of a freshwater seaweed that was normally harvested during the dry season [80]. On a similar note, International Rivers commissioned an independent expert review of the social and environmental impacts of the Pak Beng Dam in May 2017, attempting to get information disseminated early in the prior consultation process. Then, in June 2017, the Thai Network of Eight Mekong Provinces filed a lawsuit against the relevant Thai government agencies for their involvement in the Pak Beng Dam on the Mekong River, and the expected transboundary impacts on communities in Thailand. In February 2018, possibly as a consequence of so much opposition, Thailand’s electricity authority delayed signing an agreement to purchase power from the Pak Beng dam, which is being built primarily to meet Thailand’s energy demand [81].

Despite the Lao and other Mekong governments seeming to be pushing ahead with large dam projects, these examples suggest that the opposition is increasingly engaged in knowledge generation and exchange, with a significant amount of cross-border activity. This often takes the form of organizations such as the Mekong People’s Forum, which comprises representatives from local communities, and local, regional, and national NGOs. They come together to present and discuss changes that they have observed to their livelihoods, sharing research about the potential impacts
caused by the planned 11 mainstream dams (http://www.meenet.org/mekong-peoples-forum-in-an-giang-vietnam/ (retrieved on 4 August 2018)). Similarly, the Rivers Coalition in Cambodia (RCC), along with community representatives, have initiated a campaign against Don Sahong, conducting a national workshop about the dam, doing radio talk shows, and holding press conferences for national and international media to share their concerns and urge the reconsideration of the development of mainstream dams (http://www.mrcmekong.org/assets/Other-Documents/stakeholder-submissions/Final-010414-Eng-Open-letter-to-the-4-govt-on-DSH.pdf (Retrieved on 5 August 2018)). What’s more, in 2014, the Vietnam Rivers Network held 15 consultation workshops in the Mekong Delta with the participation of thousands of people, including farmers, women, and representatives of local communities from 12 provinces in the Delta. It was the first time that community members in the region had heard about Don Sahong and other proposed mainstream dams. People shared concerns about potential impacts to their livelihoods and living conditions, discussing changes in water flow, sediment, and fish migration. There was general agreement that the Mekong River is a shared water resource and common asset among Mekong countries (https://wrm.org.uy/all-campaigns/mekong-governments-listen-to-the-people-statement-to-sign-on/ (retrieved on 5 August 2018)).

Although it is largely undocumented, it is our sense that there are numerous practices of information exchange among rural residents operating throughout the basin. These residents, including farmers and fisherfolk, share knowledge regarding the shifting environmental conditions of the basin through the use of social media as well as knowledge of development projects and their immediate impacts (Ian Baird, personal communication, 27 March 2017). NGOs are also generating knowledge, with organizations such as the NGO Forum for Cambodia conducting community surveys about the process of dam construction. With regard to the Sesan 2 dam, they found that “developers fell far short of Cambodia’s legal requirements for obtaining free, prior, and informed consent from affected communities, or even conducting genuine consultations. Many people, the survey found, had not even been given official information about the project” (https://news.mongabay.com/2017/10/if-its-going-to-kill-us-ok-well-die-villagers-stand-firm-as-cambodian-dam-begins-to-fill/ (retrieved on 4 August 2018)).

Still, the politics of knowledge production and transfer in the Mekong basin remain inordinately influenced by the developmental narratives of state actors whose tropes are bolstered by the technological and engineering-based discourses that have been mentioned throughout this article. And of course, these discourses are undergirded by powerful political-economic interests manifesting across a range of state and industry actors who benefit materially from hydropower development. It remains to be seen to what extent knowledge claims challenging the efficacy of the Lao government’s three mainstream hydroelectric dams, whatever the source, will actually influence the current dams’ designs and operations, or result in the cancellation of future projects. Both the political and epistemological boundaries that we have explored here are at present conducive to enhancing state decision-making power over development initiatives. This insight makes it hard not to conclude that the types of knowledge, however contested, that are currently privileged in public knowledge controversies over hydropower development in the Mekong basin are the product of brute political-economic interests. The states of the region, as exemplified by the Lao government’s actions described here, have seen hydropower development as conducive to both economic development and, to the extent that development can be portrayed as “successful”, political legitimation. The technical and engineering knowledge that is driving the construction of the Xayaburi, Don Sahong, and Pak Beng dams is a critical component of the entire enterprise.

This raises a particularly daunting challenge for the coalitions of basin residents, academic researchers, NGOs, and others who question the dominant hydropower and developmental narratives of state actors. While the obstacles are formidable, there can be no question that we are seeing a diversification of knowledge bases—including competing scientific claims and the claims generated by local communities, NGOs, and their allies—around which decisions on hydropower dams are made and challenged. At the least, this diversification in turn has created arenas for a broader range of
political actors to confront state discourses of hydropower development and, however marginally, influence or mitigate the consequences of dam construction. Communities throughout the basin are reaching across political borders to share experiences and information, and they are simultaneously challenging the epistemological barriers that have historically marginalized their local knowledges. There are clearly practical consequences associated with challenges to these borders and barriers: the livelihoods of millions of people and the health of critical ecosystems are at stake.

At a conceptual level, a focus on knowledge flows around large dams raises critical questions about the base of information on which decisions with wide-ranging socioecological impacts (e.g., the construction of hydroelectric facilities) are made and how the actors making those decisions—typically state officials—sift through sometimes conflicting or incomplete knowledge sets. Yet flows of knowledge concerning the biophysical dynamics of transnational river systems such as the Mekong cannot be studied in isolation from other crucial processes influencing water governance. As we have argued, borders at the geopolitical level and boundaries between different knowledge domains are deeply implicated in the public knowledge controversies emerging from the construction and operation of large dams and other development interventions. These connections are certainly apparent in the case of the Mekong dams that we have highlighted here, but are also influential in transnational river basins throughout the world, and for other kinds of mega-projects. It is our hope that critical engagements with political borders and epistemological barriers in other cases will result in innovative theoretical and political practices that challenge their presumed rigidity in ways that foment the production and flow of knowledge that is more socioecologically just and inclusive.

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**References**

10. Thomas, K.A. The river-border complex: A border-integrated approach to transboundary river governance illustrated by the Ganges River and Indo-Bangladeshi border. *Water Int.* 2017, **42**, 34–53. [CrossRef]


32. Lamb, V. “Where is the border?” Villagers, environmental consultants and the ‘work’ of the Thai-Burma border. *Political Geogr.* 2014, 40, 1–12. [CrossRef]


35. Castro, J.E. Water governance in the twentieth-first century. *Ambiente Sociedade* 2007, 10, 97–118. [CrossRef]


