

Abstract:

Hydropower development is currently experiencing a global renaissance, led in large measure by Chinese dam-builders and financiers. Large dams are a key energy priority in many low and middle income countries around the globe, offering opportunities to increase energy access, improve energy security and contribute to climate change mitigation. However large hydropower dam projects have significant, irreversible environmental impacts and can also negatively impact the livelihoods and lives of direct affected groups by reducing access to local natural resources such as land, water and food, and often through involuntary resettlement. This paper investigates China's role as the world's largest builder and investor of large dams through a 'political ecology of the Asian drivers' perspective. It addresses the role Chinese actors play in large dam-building as well as the social, environmental, economic and political implications of this by drawing on two selected case studies from Asia, namely the Kamchay dam in Cambodia and the Bakun dam in Malaysia. The paper concludes that while the role of Chinese dam builders is important, particularly as a facilitator for such large and transformational investments, it is the role of national host governments that determines how large dams and their environmental and social impacts are governed and managed. The paper also illustrates how divergence between national priorities for energy production and local development needs in the area of dam sites can result in an unequal distribution of costs and benefits between these national and local scales. Finally, recommendations are made to guide more sustainable future hydropower development.

Key words: hydropower, dam, natural resources, China, Asia

1. Introduction

Large dams have been the subject of controversy and debate for several decades as a result of their large-scale and often irreversible social and environmental impacts (WCD, 2000). In the pursuit of renewable, low carbon energy and climate change mitigation, hydropower is experiencing a new renaissance in many parts of the world, despite its vulnerability to climate change (IPCC, 2011).

At the forefront of the renaissance of large hydropower dams is China, the world's largest dam builder. Internationally, China's engagement in the hydropower sector is primarily through Chinese state-owned enterprises (SOE) such as Sinohydro (also known as PowerChina / PowerChina Resources Limited), a firm leading the global hydropower sector in terms of number and size of dams built, investment sums and global coverage.

While China has a long history of domestic dam-building, recent developments have led to Chinese overseas dam-building, particularly in low and middle income countries in Asia and Africa (Bosshard, 2009; McDonald et al, 2009; International Rivers, 2012). China's rapid economic growth has depleted scarce domestic natural resources. Its 'Going Out Strategy' therefore encourages overseas investment to access natural resources such as energy and to access overseas markets (Mohan & Power 2008).

There are currently close to 350 Chinese-funded and Chinese-built overseas dams, most of them in Southeast Asia (38%) and Africa (26%). The large majority of these are large dams that have been built after 2000 (International Rivers, 2015), in a time when other dam-building nations and organisations, particularly those from the OECD, scaled down their operations in the dam-building industry.

This paper investigates China's role as the world's largest builder and investor for large dams, using a 'political ecology of the Asian drivers' perspective. It addresses the role Chinese actors play in large dam-building as well as the social, environmental, economic and political implications of this by drawing on two selected case studies from Asia, namely the Kamchay dam in Cambodia and the Bakun dam in Malaysia. Empirical research on China as a large dam-builder is still in its infancy and most of the research on China's environmental and social impact overseas is theoretical or conceptual rather than based on empirical evidence (compare Urban et al, 2013a; Urban et al, 2013b). This paper is therefore one of the first papers that provides empirical evidence for this important topic.

The following characteristics of Chinese dam-builders serve to differentiate them from their competitors from other countries: their bundling of aid, trade and investments; the role of state-owned enterprises (SOEs) that are backed by abundant state funding; their pragmatic approach to regional politics and political alliances and associated tendency not to apply conditionality in their lending; and occasionally their quest for access to natural resources (Urban et al, 2013a; Urban et al, 2013b; Hensengerth, 2013; see also Tan-Mullins and Mohan, 2013). The analysis draws on extensive research and fieldwork in Cambodia, Malaysia and China between 2012 and 2016.

Section 2 elaborates the conceptual framework and the methodology of the research. Section 3 presents the findings, and Section 4 discusses the findings and concludes the paper with recommendations

2. Material and Methods

2.1 Theory

This research uses a conceptual framework we term the 'Political Ecology of the Asian Drivers'. This is a unique approach used by the authors for the purpose of this project. This framework is a hybrid approach that draws on the political ecology of China's engagement in overseas hydropower projects and the Asian Drivers framework (citation) for explaining the rise of China and its global, national and local impacts. This is outlined further below.

The majority of earlier work on China's engagement with low and middle income countries (LMICs) has been speculative (Mohan 2008), economic (Jacques 2009), and Africa focused (Alden et al 2008, Brautigam 2009). Crucially these studies have largely ignored the environmental consequences of China's internationalisation. Understanding a complex set of international actors, interdependencies and ecological impacts necessitates a broad theoretical framework (Urban et al, 2013b; Urban et al, 2015).

We use the political ecology framework (Wolf 1972, Greenberg & Park 1994) as a basis for analysing the conflicts caused by the varied forms of control over the access to natural resources such as water, energy, land and forests (Bryant & Bailey 1998, Blaikie 1985, Peet & Watts 2004). Power relations

between different actors are at the heart of this framework (Tan-Mullins 2007) and assessing the unequal power relations between actors allows us to explain the uneven distribution of access and control of environmental resources. Power relates to the differential ability to control and/or access the economic benefits from resource exploitation (Bryant 1996, 1997, Peluso 1992, Dauvergne 1994). Bryant and Bailey (1997) developed three fundamental assumptions in practicing political ecology in developing countries. First, costs and benefits associated with environmental change are distributed unequally. Second, this unequal distribution inevitably reinforces or reduces existing social and economic inequalities. Third, the unequal distribution of costs and benefits and the reinforcing or reducing of pre-existing inequalities holds political implications in terms of the altered power relationships that result.

We combine this theoretical framework of political ecology with the distinctive approach of the ‘Asian Drivers’ and their impacts to address China’s role in overseas dam-building. This framework has already been used by the authors in an amended form to assess the motives and implications of Chinese investments in the hydropower sector in the Greater Mekong Sub-Region (Urban et al, 2013a; Urban et al, 2013bb). The Asian Drivers framework developed by Humphrey and Messner (2005, 2006), Schmitz (2006), and Kaplinsky and Messner (2008) assesses China’s direct and indirect impacts as a Rising Power and its channels of interaction with LMICs. In each of these channels - aid, trade, investment, global governance, individuals/migrants and environment – there will be a mixture of complementary and competitive economic impacts and positive and negative impacts in relation to society and the environment (Kaplinsky & Messner 2008). Urban et al (2013a; 2013b; 2011) advanced the Asian Drivers Framework further by addressing motives, actors and beneficiaries in addition to impacts, to analyse in more depth how, why and with which impacts Chinese actors engage in LMICs. Table 1 shows an amended version of the Asian Drivers framework. Source: Urban et al, 2013.

Channel	Motives	Actors	Beneficiaries	Impacts			
				Positive		Negative	
				Direct	Indirect	Direct	Indirect
Trade							
Investment (FDI)							
Aid							
Innovation							
Politics							

Taken together this framework of the ‘Political Ecology of the Asian Drivers’ enables us to address how Chinese investment strategies in large hydropower dams are managed vis-à-vis LMICs; their impacts on local social and environmental conditions in recipient countries; the effects on local and regional governance; and the implications for global hydropower development.

2.2 Material and methodology

The research involved an interdisciplinary, multi-sited, comparative case study approach involving four years of in-depth, empirical research between 2012 and 2016, linking the theory of the 'Political Ecology of the Asian Drivers' to the methodology.

For our fieldwork, we selected the the Kamchay dam in Cambodia and the Bakun dam in Malaysia. Each of these dams involves the Chinese as dam developers, and has a capacity of more than 50MW. We conducted 67 semi-structured in-depth interviews in Cambodia and Malaysia and China and 20 focus group discussions (FGDs) with the affected communities (Table 2). The five affected communities interviewed in Cambodia are Bat Kbal Damrei, Mortpeam, Ou Touch, Snam Prampir, Tvi Khang Cheung in Southern Cambodia. These communities rely mainly on farming, fishing and the collection of forest products, such as timber, wild fruits and bamboo. In Malaysia, the major ethnic groups resettled due to the Bakun dam are the Kayan and Kenyah, three longhouses were chosen to represent them, namely Uma Belor and Uma Balui Ukap (Kayan), as well Uma Badeng (Kenyah). The minority ethnic groups who were included in the study were the Lahanan, Ukit and Penan, all located in Sarawak, Borneo, East Malaysia.

We also conducted a multi-level stakeholder mapping to identify key stakeholders engaged in Chinese overseas hydropower projects for each of the host countries and China. We used the Net-Mapping Approach for the stakeholder analysis to determine key stakeholders, direct and indirect links to other stakeholders and power relations (Schiffer, 2010). Secondary data were compiled to assess the environmental impacts of dams and their governance implications by examining the Environmental Impact Assessment (EIA) reports of the dams and also firm strategy documents and Corporate Social Responsibility (CSR) documents. We analyzed the qualitative data obtained through interviews and FGDs by categorizing and coding the sources as a means of comparing and contrasting interpretations of events (Wolcott, 1990). We used the Nvivo 10 software to analyse the interview and focus group consultation data. These were analysed using narrative analysis (Wiles et al, 2005) rather than conventional 'code and retrieve' since the former allows for more layers of embodied meaning to be revealed by including narrative style. This allows us to compare several cases to be able to draw parallels from similar findings and flag up any differences (Yin, 2009). Some of the most commonly referenced terms were 'livelihood changes' and in particular 'decreased livelihoods', as well as 'employment', 'access to natural resources', particularly 'land', 'energy access' as well as 'compensation' and 'complaints'.

Case studies

The two case studies have been selected for their social and environmental implications, as specified below.

Kamchay dam

The Kamchay Dam is the first large hydropower dam in Cambodia. The Department of Environment in Kampot province claims that the dam can supply up to 60% of Cambodia's energy demand, at least in the wet season. The Kamchay dam has a generating capacity of 193MW and the expected annual output is 498 GWh, however in the dry season the generating capacity may be as low as 60 MW, which is less than a third of the nameplate capacity (NGO Forum, 2013). The electricity produced by Kamchay

dam is mainly used to satisfy the energy demand of Phnom Penh. This dam is a 'classic' Sinohydro-ExIm Bank project, similar to many Chinese overseas dams. The dam cost an estimated US\$280 million and is financed by China ExIm Bank as part of a US\$600 million aid package to Cambodia. The dam is based on a concessional loan from ExIm Bank that has to be re-paid with 6% interest rates (International Rivers, 2010). The Kamchay dam was subject to Build Operate Transfer (BOT) contract. As in the case of the Kamchay dam, even though resettlement of the local population did not take place, there are a range of reported environmental and social issues related to loss of livelihoods of the local population, dam construction in a National Park and late EIA approvals (International Rivers, 2014). The dam is located on the Kamchay River in Bokor National Park. Again, as in the case of Ghana, the dam is located in a protected area that is the habitat of endemic and rare species. Bokor National Park is an extension of the Cardamom Mountains and is located at the southern tip of the Elephant Mountain Range. The area is famous for its rich biodiversity, its forest-covered hills and its rivers. It hosts 39 mammal species -including 10 endangered species mentioned on the IUCN Red List-, 68 bird species, 23 reptile species and 192 fish species. The threatened species include the Asian elephant, the sun bear, the leopard cat, and the tiger (Middleton, 2008; Grimsditch, 2012). 2,015 ha of protected forest were lost due to the flooding for the reservoir and an overall total area of 2,291 ha was destroyed (Grimsditch, 2012). Sinohydro announced that it will replant 2,000 ha of forest (Middleton, 2008), however this has not happened yet. The dam has negatively affected fish stocks and it is estimated that the migration of at least 15 fish species has been severely affected, including threatened species.

Bakun dam

The Bakun dam is the first and largest dam in Borneo, Malaysia. It is the third largest concrete rock-filled dam in the world. It is located in the tropical rainforest in Belaga District, East Malaysia, Sarawak, on the river Balui. The dam development includes a reservoir occupying 14,170 km², which corresponds to 12% of Sarawak State or the size of Singapore. The area is a biodiversity hotspot in Borneo's tropical rainforest and the habitat of many endemic and endangered species, including the orangutan. The Bakun dam has a generating capacity of 2,400MW and an estimated cost of US\$2.6 billion. The financiers are ExIm Bank, while the developers are the Malaysia-China Hydro Joint Venture consortium composed of Malaysian Sime Darby, Chinese SOE Sinohydro and others. Sinohydro is also the builder. The Bui dam was subject to an Engineering Procurement Construction (EPC) (turnkey) contract. The dam operator is the Malaysian utility company Sarawak Hidro. The electricity is mainly used to satisfy the energy demand of urban areas in Sarawak. Bakun is the first of a series of large dams built on the land of the indigenous Orang Ulu people. A total of 15 longhouses composed of about 10,000 indigenous people from the upper Balui river, including some semi-nomads, had to be resettled to sedentary settlements at Sungei Asap for the dam construction. Approximately 50% of the impoundment area of the Bakun dam is lands claimed under customary rights (Sovacool and Valentine 2011). The cost of resettlement was funded by the Federal Government. The actual implementation of resettlement was undertaken by the State government (interview Sarawak Hidro 29 June 2015).

3. Results

This section presents the results obtained throughout the project. The section first addresses the role Chinese actors play in large dam-building and then compares the social, environmental, economic and political implications of Chinese-built and Chinese-financed overseas dams by drawing on the four selected case studies.

3.1 The role of Chinese actors in global dam-building

This analysis is based on the Asian Drivers approach, analysing the channels of interaction between China and the dam host countries (such as aid, trade, investment) analysing the complementary and competitive economic impacts, addressing motives, actors and beneficiaries. This paragraph shows how Chinese investment strategies in large hydropower dams are managed vis-à-vis LMICs.

There are numerous Chinese dam builders, and the companies registered and operating in China can vary from those subsidiaries specifically set up for overseas operation. These actors are usually the ones with the most power to inscribe change on the environment, and subsequently on livelihood options and power relations between the stakeholders at the local level. The main players in overseas hydropower dam building are: China Datang Overseas Investment Company (subsidiary of Datang International Power Generation Company), Gezhouba International, China Huadian Corporation, China Huaneng Group, PowerChina Resources Limited (which is an international subsidiary of Sinohydro), Sinohydro Corporation (also known as PowerChina), and China Three Gorges Corporation. There are other small players in the industry, such as suppliers and grid operators which includes Hydro China, Dongfang, China Southern Grid, China State Grid. There are several Chinese dam financiers such as China Export-Import Bank (Exim Bank), Chinese Development Bank (CDB), Sinosure, and to a lesser extent commercial/or non-policy banks, Industrial and Commercial Bank of China (ICBC) and the Bank of China (BoC) (Tan-Mullins et al, forthcoming).

The majority of these overseas dams are located in Asia (57%, mainly in South East Asia, 38%), followed by Africa (26%), Latin America (8%), Europe (7%, mainly Eastern Europe) and the Middle East and the Pacific (1% each). Most of these dams are located in high environmental and social risk areas, such as remote rural areas affected by poverty, areas with high biodiversity, such as natural parks or areas highly important for the supply of food and livelihoods to local populations, such as the Mekong River system or other rivers (International Rivers, 2015).

Many of the companies' respondents indicated that other than profits, the contributing factors for them to invest overseas includes the 'going out policy', stiff competition within China, sector reforms due to an increasingly saturated internal market, decreasing suitable sites for new dams in China, lack of international competitors and national policy directives. Low costs, access to finance (and at times cheap loans) and a big portfolio of domestic projects also make them attractive partners for clients around the world (Tan-Mullins et al, forthcoming).

There are different Chinese ministries with varying degrees of involvement in the project cycle of an overseas Chinese dam project. They are the State Council, Ministry of Commerce (MOFCOM), Ministry of Foreign Affairs, (MOFA), National Development and Reform Commission (NDRC), Ministry of Environmental Protection (MEP), and the State-owned Assets Supervision and Administration Commission (SASAC) (Urban et al, 2013b). Every project that is greater than US\$2 billion requires approval from the State Council, endorsement by NDRC and MOFCOM approval (IR, November 2012, p. 7). Furthermore, the State Council is also the overarching agency that oversees MOFCOM and NDRC,

two very important stakeholders in approving and overseeing overseas dam projects. MOFCOM is the main institute that approves and manages overseas investment of the SOEs, which includes hydropower dams. NDRC approves smaller projects (less than US\$2 billion) and regulates overseas investments. MOFA then provides advice on China foreign policy, such as aid matters while the MEP provide advice on environmental protection issues such as use of EIA/ESIA. Finally SASAC assesses the performance of these SOEs (IR, November 2012, pp. 8-9). As indicated above, although some decisions are driven more by national policies than revenue, we should not over-estimate the power of these ministries over the companies. The Chinese government can and does influence these companies if there is a strategic objective to pursue, but beyond this the companies are not generally under the control of the national government and are governed by boards and private investors.(Tan-Mullins et al, forthcoming). Beneficiaries are primarily SOEs, but also the Chinese government that receives tax incomes from the overseas operations.

3.2 The impacts of large Chinese-funded and Chinese-built dam projects at Bakun and Kamchay

The last section discussed the role of Chinese dam-builders and their overseas operations. This section elaborates the environmental, social, economic and political impacts of Chinese dam projects in Asia and Africa. This is linked to the Political Ecology of the Asian Drivers framework by assessing the positive and negative impacts of Chinese overseas dam-building in relation to society and the environment and by assessing the three factors that determine the political ecology of dam-building, namely that costs and benefits associated with environmental change are distributed unequally; the reinforcement of existing inequalities; the political implications in terms of the altered power relationships that result. Linking this to the Asian Drivers framework, this section also shows how the impacts of large Chinese dams are affecting local social and environmental conditions in recipient countries.

We start by outlining the environmental, social, economic impacts which are inter-related, leading to the important issue of limited access to natural resources such as land, energy, water and forests post-dam construction. We then discuss politics and governance issues separately at the end of this section.

Land scarcity, reduced land fertility and land insecurity are some of the negative impacts affected villagers have perceived after the construction of the dams. Moreover, access to important natural assets needed to support local livelihoods, such as non-timber forest products (NTFPs), has become more problematic for indigenous people after the construction of the dam due to the presence of land enclosure put in place by private companies and dam builders. To the contrary, energy access has improved for resettled communities in Sarawak, Malaysia. However, in the case of Cambodia there are still households located close to the dam without access to electricity. The impacts are summarized in tables 3 and 4 and the following sections discuss the results with details from each case study.

Table 3: Positive impacts (benefits) of large dams on affected communities¹ in relation to access to land, food, forest products, water, energy as well as infrastructure and social amenities

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	Bui	Bakun	Kamchay	Zamfara (expected impacts)
Access to land	---	---	Partly reduced flooding	---
Access to forest products	---	---	---	---
Access to food	Improved access to markets	Improved access to markets	Improved access to markets	Improved access to markets
Access to energy	Energy access	Energy access	Energy access for some, not for others	Energy access
Access to water	---	---	---	Improved irrigation and potable water access
Access to infrastructure	Access to roads	Access to roads	Access to roads	Access to roads
Access to social amenities	Access to schools and clinics	Access to schools and clinics	---	Access to schools and clinics

¹ Affected communities are those already resettled due to the dams (Bui and Bakun), those to be resettled due to the dam (Zamfara) and those who live in close proximity to the dam and had severe livelihood declines / losses due to the dam (Kamchay).

Table 4: Negative impacts (costs) of large dams on affected communities in relation to access to land, food, forest products, water, energy as well as infrastructure and social amenities

	Bui	Bakun	Kamchay	Zamfara (expected impacts)
Access to land	Resettlement resulting in land scarcity, reduced land fertility and land enclosure	Resettlement resulting in land scarcity, reduced land fertility, land enclosure, increased distance to access agricultural plots	Land enclosure	Proposed resettlement, impacts unclear at this point
Access to forest products	Reduced access to NTFPs; Increased distance to access NTFPs	Reduced access to NTFPs; Increased distance to access NTFPs	Reduced access to NTFPs; Increased distance to access NTFPs; land enclosure	---
Access to food	Reduced food self-sufficiency; Commodification of food	Reduced food self-sufficiency; Commodification of food	Reduced food self-sufficiency; Commodification of food	Unclear at this point, risk of reduced food self-sufficiency due to resettlement and loss of traditional lands
Access to energy	---	---	Limited energy access: some have energy access, others do not	---

Access to water	Increased distance to access the river for fishing; Water scarcity and competition	Increased distance to access the reservoir for fishing; Decreased water quality	Decreased water flow and quality	Impacts unclear at this point
Access to infrastructure	---	Road development has led to rainforest habitat destruction and opened the way for logging and palm oil companies and other industries to exploit the formerly inaccessible land	---	---
Access to social amenities	---	Some families are too poor to pay the school transport costs for their children, hence the children do not attend school	No school or clinic built in the area	---

Access to land, food and forest products

We found that the main sources of concern for the affected communities are land scarcity and access to forest products. Access to land for farming has dramatically decreased after resettlement in the Bui dam and Bakun dam case studies. This is causing problems either in terms of food self-sufficiency as community members after resettlement rely more on the market for food provision, or in terms of the possibility of engaging in commercial farming activities. Moreover, low land fertility in the resettlement sites has also been mentioned by affected villagers as a huge problem (Siciliano et al, forthcoming).

In the case of the Bakun dam, after resettlement each family was provided with 3 acres of land in the resettlement sites as compensation for the lost land in the reservoir area of the dam where people had free access to customary land. This land was cultivated mainly with rice and vegetables for subsistence purposes and it was enough to support family needs: *“After we moved here, the land is*

just 3 acres. In our old place, our land was large and they replaced it with only 3 acres. In one family there are so many siblings and the land is not enough for one family or for family expansion" (quote from FGD with men in Uma Badeng). Issues of land fertility in the resettlement sites have also been mentioned by the villagers interviewed: *"almost everything is unsuitable to be planted here, vegetables as well. The only thing that is suitable is oil palm trees, but there is not enough space to plant them in the three acres of land"* (quote from female respondent in Uma Juman). Difficult access to the three acres of land received by the government as compensation is also an issue for the resettled communities. Land allocated to resettled communities is often located far away from the resettlement site and there is no proper road to access the land. Some villagers reported that they have to walk for two hours to reach their lands: *"Regarding the agricultural plots, some villagers were unable to plant. It is impossible for you to walk for two hours carrying 50kg of fertilizers. At the old place we used waterways for transportation"* (quote from male respondent in Uma Juman).

In terms of access to food, the presence of land enclosures by private planting companies, such as oil palm and rubber companies (in the case of Sarawak, Malaysia) or dam builders (in the case of Ghana) make it difficult for resettled communities to access the lands surrounding the resettlement sites. This is restricting their ability to hunt and fish, as reported in the following quote from a villager in the resettlement site in Sarawak, Malaysia: *"In the up river (old place), it was easy for us to find food and here the entire compounds have been blocked by plantation and logging companies* (quote from FGD with men in Uma Badeng resettled longhouse). As a result, resettled communities are more dependent on the market for food provision and life is in general more costly in the resettlement area, as reported in the following quotes: *"In our old home, it was easier for us to earn a livelihood. We didn't use money. Now, that we have moved here we need to use money. If we go to the market to buy vegetables, buy meat, how could we live? Even transportation to the market costs RM5"* (quote from female respondent in Uma Bakah resettled longhouse).

In the case of Kamchay dam, the interviewees reported that access to non-timber forest products (NTFPs), such as bamboo and firewood, but also access to fish downstream has dramatically decreased after the construction of the dam. The dam has flooded 2291 ha of land and forest in Bokor National Park, which was previously used by the local communities for the collection of NTFPs (Siciliano et al, forthcoming).

Moreover, villagers reported that occasionally Sinohydro puts a ban on bamboo collection and closes off access to the area completely. It also takes the local people longer to access a smaller bamboo area further away where Sinohydro allows access: *"We can collect less bamboo, but spend more than before"; and "We spend on petrol, raft and truck fees"* (quotes from FGD with men in Ou Touch).

The reduced bamboo forest areas due to the flooding of the reservoir and the difficult access to the forest left upstream of the reservoir have severely undermined the livelihoods of the local communities, especially for those relying on NTFPs collection, such as bamboo collectors and fruit sellers. The bamboo collectors are the biggest group as bamboo weaving is their main source of livelihood, which has been adversely affected by the Kamchay dam. Many of them also do not own any land nor have any assets and most of them have very low literacy rates and can therefore not easily move on to more skilled jobs. As reported in the quotes below, the only livelihood alternative for the bamboo collectors is to work as construction workers; however the income they can get is not enough to support their family needs: *"We have no jobs to do beside collecting bamboo, and working*

as a construction worker cannot support our family because you can earn only around ten thousand Riel per day, and collecting bamboo we can earn more than twenty thousand Riel per day" (quote from FGD with men in Ou Touch).

Access to water

In terms of water access, according to the results of the Nvivo analysis, water scarcity is a problem in some of the resettlement sites. In the case of the Bakun dam, in terms of access to water resources villagers reported that the water they can access in the resettlement site is irregular, polluted, full of sediment, smelly (smell of rust) and with a yellowish colour. Some villagers have also stated that water pollution comes from the chemicals used in the oil palm plantations owned by private companies located on the banks of the river, as commented here: *"The water is not clean, it is like mud. Although it seems clean now, if we put it in the bottle after 2 or 3 days there is yellow sediment at the bottom of the bottle"; and "Because at the upstream, i.e. Koyan River (a water catchment), there are many oil palm plantations, they use a lot of pesticides, and they go into the water, it is a big problem."* (quotes from FGD with men in Uma Badeng resettled longhouse).

Access to energy

In terms of energy access, the resettled people at the Bakun dam have benefitted from the dam construction. Pre-dam construction they did not have access to electricity, while after the dam construction the government has provided them with electricity, as reported: *"The thing we appreciate most about our coming here is that previously we didn't have electricity at the village close to the lake but now we have light"* (quote from Bui FGD with men in Jama resettled village). Similarly the old village people at Bakun did not have electricity and used generators or kerosene lamps. At the resettlement site all villagers are connected to the grid and have electricity provided by the government, as stated here: *"Our lives are more convenient here with electricity"* (quote from female respondent in Uma Belor resettled longhouse).

The energy access situation is different in Cambodia. As reported by the villagers, there are houses located close to the dam that do not have access to electricity yet: *"Most of the houses do not use electricity, they use kerosene lamp" and "[...] the price of electricity is too expensive"* (quote from FGD with women in Mortpeam). One of the main reasons for the lack of electricity for the locals is because most of the electricity generated at the Kamchay dam is being used in Phnom Penh, as the capital needs power to generate economic growth, while locals receive electricity from Vietnam: *"which is from a private enterprise. We live next to the dam, yet the price of electricity is more expensive here than for other villages in the province"* (quote from FGD with men in Bat Kbal Damrei). Nevertheless, the price of electricity after the construction of the dam has been reduced from 1,800 Riel per kWh to 920 Riel per kWh. However, even though electricity has become more affordable, many people do not have the financial means to connect to the grid as it requires a connection fee of US\$160 per household, as the villagers report (Siciliano et al, forthcoming).

Access to infrastructure and social amenities

While the dam-building has mainly imposed costs on the local population with regards to access to natural resources, there are benefits with regards to access to infrastructure and social amenities. The

local communities at the Bakun dam in Borneo reported that the biggest positive impact of the dam-building is the access to clinics and schools. Particularly child birth has become safer for women as child birth are assisted by medics in the local clinic of the resettlement site, instead of at home or hours' boat ride away. The local communities at Bakun also strongly value the availability of schools at the resettlement areas. At the Kamchay dam however, no provision was made post-dam construction for social amenities like schools or clinics. On the negative side, the road constructions at Bakun not only opened up the rainforest for accessing the dam site, but also allowed access to a wide range of other commercial operations, most importantly logging and palm oil companies that are operating in the formerly inaccessible area.

With regards to the Political Ecology of the Asian Drivers, this shows that the costs and benefits associated with environmental change induced by the dams are distributed unequally and that reinforcement of existing inequalities occurs. Impoverished, rural communities at the dam sites are experiencing the negative impacts of the dams by declines or complete losses of livelihoods, threats to food security, loss of traditional lifestyles. At the same time, the benefits are with large companies, particularly Chinese SOEs, the Chinese state as well as urban dwellers who receive electricity from the dams, such as in Phnom Penh. At the same time, the poor and marginalised are being further disproportionately affected. In the case of the Bakun dam, almost 10,000 people from ethnic minorities have been disproportionately affected. The Penan people now live in poverty and have difficulty coping with the loss of their traditional livelihoods.

The political implications in terms of the altered power relationships that results from these issues will be elaborated below. Issues related to the governance of the impacts of dam construction in the case study areas, such as the implementation of mitigation strategies, consultation with affected communities and compensation, are discussed in the following section.

Politics and governance issues of environmental and social impacts of large dams

This section addresses the political implications of large Chinese dam-building in Cambodia and Malaysia, in terms of the altered power relationships that results. This links back to the third assumption of the Political Ecology conceptual framework that the unequal distribution of costs and benefits and the reinforcing or reducing of pre-existing inequalities holds political implications in terms of the altered power relationships that result from it. This section also indicates the effects on local and regional governance, with particular focus on Environmental and Social Impact Assessments.

Most countries have legislated to ensure that for projects such as large dams with the potential for very significant environmental and social impacts an Environmental Impact Assessment (EIA) or an Environmental and Social Impact Assessment (ESIA) is conducted and approved by local authorities before construction starts. Such assessments should evaluate the potential environmental and social risks and impacts; examine project alternatives; identify ways of improving project selection, siting, planning, design and implementation in order to mitigate adverse environmental and social impacts and seek opportunities to enhance positive impacts (World Bank, 2015). For large dams specific requirements will usually include a resettlement planning framework including compensation to be provided to the affected communities. Moreover, according to international guidelines and standards, affected communities should be consulted and actively involved in the assessments and subsequent decision making from the beginning of the planning and then construction process (WCD, 2000). In the case studies analysed we found various shortcomings in the preparation of the EIAs/ESIAs,

consultation and participation of the local affected people, as well as the implementation of social and environmental mitigation and safeguard measures, as specified hereafter. This is partly due to the Chinese investors and dam-builders and partly due to the host governments in Asia and Africa, depending on the specific dams.

Kamchay dam

In contrast to the Bui case the Kamchay dam operates on a Build Operate Transfer (BOT) contract between the Chinese hydropower firm Sinohydro and the Cambodian government. After a lease of 44 years, the dam will be transferred from Sinohydro to the Cambodian government. The deal was negotiated at the highest political level directly between the Chinese and the Cambodian government, most importantly by Prime Minister Hun Sen. As such the dam played a major role in intensifying the business operations and improving the bilateral relations between China and Cambodia.

By Cambodian law, development projects such as dams are required to have an EIA in place and need to be approved before the dam construction begins and consultation with all stakeholders is required. The main legal framework for the EIA is the Sub-decree on EIA passed by the Cambodian Ministry of Environment (MoE) in 1999. The MoE is primarily responsible for organising the conduction of the EIA, reviewing the report and monitoring compliance with environmental legislation (Grimsditch, 2012). However at the Kamchay dam, the full EIA was approved only after the dam construction was completed and in operation, while the consultation process before the dam construction was patchy and ad-hoc with little local participation as our fieldwork finds and other reports confirmed (International Rivers, 2013). According to our interviews village chiefs were involved in the consultation process but given little opportunities to participate: *“They invited me to attend a consultation at their Chinese hydropower company (Sinohydro). However, we just went to listen to them”*; and *“during consultation the company already told us that people should find alternative jobs instead of collecting bamboo”* (village chief in Ou Touch).

In addition, the Environmental Management Plan (EMP) which aims to implement mitigation measures to reduce the negative effects of the dam was not in place until the late stages of the dam construction. It is also being reported that Sinohydro did not implement any mitigation measures, as confirmed by our interviews and other reports (NGO Forum, 2013). Sinohydro is said to have set aside a so-far untouched budget of US\$ 5 million for implementing mitigating measures, such as replanting 2,000ha of forest (Middleton, 2008), however even high-ranking officials at the provincial Department for the Environment and the EIA office are criticising Sinohydro for its inaction as confirmed by our interviews. Moreover, in terms of compensation bamboo collectors, fruit vendors and fishers who lost livelihood security to the dam were not considered for compensation payments, as they did not have legal rights to the land they were using for collecting NTFPs needed to support their livelihoods.

Given the characteristics of the BOT contract this case illustrates failure in capacity and political will on the part of the national government in the form of the Cambodian ministries, and most specifically with regard to ensuring that the dam developer fulfils its commitments for environmental and social impact mitigation. A weak state is likely to be most in need of the more accessible development finance and technical assistance available for dam projects from China, and less resistant to strategic ‘soft power’. The domestic political economy of a weak state may also be more vulnerable to capture

by elite interests, content that Chinese dam developers do not seek to impose stronger supervision and conditionality for project implementation. Linking this back to the conceptual framework of the Political Ecology of the Asian Drivers, we see in the Cambodian case that Chinese investors and dam-builders exert a high level of power over national Cambodian authorities, even to a degree where the altered power relationship caused by Chinese dam-builders led to an over-ruling and disregarding of Cambodian legislation and Cambodian government authorities.

Bakun dam

The Bakun dam operates on an EPC contract. The developers are the Malaysia-China Hydro Joint Venture consortium composed of Malaysian Sime Darby, Chinese Sinohydro and others. Sinohydro is also the builder, but had little engagement with the governance and the management of the dam and its impact. This is being led by Malaysian government authorities, particularly federal state authorities, including dealing with the resettlement of about 10,000 indigenous people and their compensation.

In the case of the Bakun dam, specific national environmental requirements need to be fulfilled before large infrastructure projects such as dams can be built. One of the most important environmental requirements is the preparation of the EIA which after completion needs to be approved by the Malaysian Director General of Environmental Quality. University Malaysia Sarawak (UNIMAS) acted as the main consultant for the EIA of the Bakun project. Interaction and communication with resettled people during the preparation of the EIA including negotiations of compensation terms, land allocations and resettlement have been carried out mainly between village leaders, village committees and Malaysian state departments. However, according to interviews resulting recommendations were never taken into consideration by the government. Moreover, villagers have only been informed by the government about the benefits of the dam, they did not directly participate in the negotiation process, beyond the village leaders: *“The suggestions given from villagers to the government were from everyone from the 15 villages that were involved. So, they gave suggestions about the resettlements during a meeting organized by the government with village leaders, on the allocation of lands, compensation and all, but sadly the suggestions were not followed”* (quote from village man in Uma Juman). Moreover looking at compensation issues, interviewees stated that in terms of house compensation, it was only after more than ten years of complaints and struggles with the government that villagers were granted without cost to them a new house in the resettlement site.

What we see for the Bakun dam is that the Chinese mainly played a role as investors and contractors, however there were challenges with national elite capture and struggles between the federal Malaysian government authorities and the Sarawak state government authorities. The federal authorities exerted power over the state authorities, including dealing with sensitive issues such as resettlement of indigenous people, confiscation of customary land, inadequate compensation etc. To link this back to the conceptual framework, this indicates again that power relations changed over the struggles associated with the dam-building.

4. Conclusions

The analysis presented above finds that while the role of Chinese dam builders is important the role of national and regional host governments is often determining how large dams and their

environmental and social impacts are governed and managed. Using the conceptual framework of the Political Ecology of the Asian Drivers, the paper also indicated that the divergence between national priorities of energy production and local development needs can result in the unequal distribution of costs and benefits between the national and local scales indicated in our theoretical approach, as the natural resource analysis above has shown. This includes for example the decline in or complete loss of traditional livelihoods at the Bakun and Kamchay dam for the affected population due to the dam, while the benefits of the dam are felt in urban areas through electricity export and by Chinese dam-builders who reap the financial profits of the dam deals. At the same time, this unequal distribution of costs and benefits reinforces existing social and economic inequalities. The local population affected by the dam was already marginalised and impoverished pre-dam construction, a fact that the dam-building has only exacerbated. The 10,000 indigenous people of Bakun have lost access to their customary land, forests and rivers and are struggling with ensuring food security and making a living post-dam construction, particularly the formerly semi-nomadic Penan, whereas pre-dam construction they had access to a vast area of land that made it easy to provide food and income. Our analysis also showed that the unequal distribution of costs and benefits and the reinforcing of pre-existing inequalities hold political implications in terms of the altered power relationships that result. For example, at the Kamchay dam the Chinese dam-builders violated Cambodia's EIA legislations due to a power imbalance that was created between the strong interests of the Chinese dam-builders and the weak role of Cambodian government authorities that led to a weak enforcement of Cambodian law.

With regards to the environmental implications, some dams are being built in protected habitats or areas of outstanding natural value, including the Kamchay dam that were built in Bokor National Park, Cambodia and the Bakun dam that was built in the tropical rainforest of Borneo, Sarawak, East Malaysia. These areas are home to endangered and/or endemic species such as the black hippopotamus (Bui), the Asian elephant (Kamchay) and the orangutan (Bakun). Dam construction, flooding the reservoir area and building access roads has destroyed the habitat of these species and other animals and plants.

Finally, this project finds that Chinese dam-builders and financiers open up opportunities for low and middle income countries in Asia to attract large investments, to build up energy and water management infrastructure which in turn can contribute to national development goals. Accessibility of finance and technical expertise from China, without the conditionality that might be uncomfortable for the local political economy, facilitates transformational and high environmental and social risk projects that are otherwise 'rationed' by the conditionality and practice of agencies such as the World Bank and by the higher opportunity cost for other sources of finance. The 'no strings attached' policy of Chinese dam-builders is a welcome offer to many low and middle income countries. Hydropower dams also contribute to low carbon energy generation and thereby create viable alternatives to fossil fuel energy generation, such as coal, oil and natural gas, thereby mitigating climate change. However dam planning and building needs to be done in a more sustainable way that takes into account national development priorities, the needs of local people and the impacts on natural habitats. To be more specific in outlining the implications for global hydropower development, this will require more adequate compensation payments for local people, for example long-term compensation rather than one-off payments, compensating for livelihood losses/declines for up-stream and down-stream affected communities; offering pre-planted land rather than barren land that takes years to reach any agricultural output. More sustainable hydropower practices will also require better siting, e.g. not choosing the lands of indigenous people or National Parks as potential dam sites; conducting proper

EIAs in accordance with national legislation and international standards; consulting local people properly and implementing mitigation measures such as afforestation measures.

With regards to the role of Chinese dam-builders, our research finds that indeed the corporate behavior of Chinese dam-builders is to a large extent influenced by the national legislations, policies and practices set by the national governments in Asia, but international public institutions and industry bodies, such as the World Bank and the International Hydropower Association IHA, could further provide international standards and monitoring for responsible corporate behavior in the Chinese hydropower sector. This will however mean that Chinese dam-builders need to be willing to take on the recommendations of the World Bank and the IHA, which is today rather limited practice. By working together and showing more willingness to improve the hydropower sector, Chinese dam-builders and financiers, national host governments, and international public institutions and regulatory bodies can help to make the hydropower sector more sustainable.

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