Hydropower, social priorities and the rural-urban development divide: the case of large dams in Cambodia

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Abstract

Hydropower investment is a priority in many developing countries, as a means to increase electrification rates and promote national development. However, neglect of dam-affected people's needs, can make them vulnerable to the multifaceted impacts of such projects. Using the case of Cambodia's first large dam, the Kamchay dam, this paper reveals social priorities of affected communities and institutional actors linked to environmental and social implications of large hydropower projects using a preference ranking method. Qualitative research revealed concerns among dam-affected communities which included energy access, livelihood changes, environmental impacts, access to natural resources and compensation. Results also reveal divergence between national and local priorities, which in turn brings about an unequal distribution of costs and benefits of the Kamchay Dam between urban and rural areas. The paper provides recommendations to policy-makers, NGOs and international organizations regarding governance issues, consultation processes and mitigation measures.

Keywords: hydropower, dams, development, impacts, social priorities, Cambodia

Introduction

This paper aims to analyse the local perceptions of the social and environmental impacts of large dams post-construction by affected community members and institutional actors and to discuss how the impacts of the dams are distributed between the national and local scales, as well as rural and urban areas.

The resurgent interest in large dams as a means to reduce energy poverty, especially in developing countries, and to mitigate global climate change (International Rivers, 2013; World Bank, 2013, 2009), has revived interest in their social and environmental implications and the way they should be managed (Skinner and Haas, 2014; Urban and Siciliano, 2014). Recently, new large hydropower projects have been planned all over the world, but particularly in developing countries. South-East Asia has become the world's top investment region for large dams (International Rivers, 2013). In Southeast Asia, 72 new projects have been planned in Laos, 10 in Sarawak Malaysia, more than 50 in Cambodia and at least 6 projects in Myanmar and at the border of Thailand-Myanmar (Hataway, 2010; Millikan, 2010; Ministry of Energy and Mine, 2012; ODC, 2014). Access to modern energy services is particularly poor in Southeast Asia compared to most other parts of the world, with Cambodia and Myanmar having the lowest rural electrification rates (IEA, 2013). Hydropower development is therefore a key energy priority in most Southeast Asian countries (Suhardiman et al., 2011). Cambodia is one of the countries that has large hydropower potential and is actively exploiting it by attracting foreign investment from Chinese and other dam-builders (International Rivers, 2013). The focus of this paper is the 194-megawatt Kamchay Dam, which is the first large dam ever built in Cambodia and the only one that has been fully operational since 2011. It is also the first dam funded and built by Chinese dam-builders. Being the first large hydropower project in Cambodia, the Kamchay Dam is an important test case that provides insights into post-project impacts and how they have been perceived by the local populations and institutional actors.

Nevertheless, large hydropower dams have also been controversial in terms of their social and environmental sustainability. In terms of the biophysical aspects, the main impacts refer to fragmentation of river systems, but also fragmentation of the vegetation, impacts on soil and water quality, impacts on species composition and aquatic biota, and changes to geomorphology (Bakken et al, 2014; Brown et al, 2009; Burke et al, 2009). Regarding social impacts the most critical are displacement, resettlement and migration, changes in livelihood strategies, poor compensation, impacts on culture and social relations, impacts on community health and gender relations, and loss of land and water access (Brown et al, 2009; Lerer and Scudder, 1999; McDonald-Wilmsen and Webber, 2010; Jackson and Sleigh, 2000; Tilt et al, 2009; Tullos et al, 2013; Urban et al, 2013; WCD, 2000; Majid Cooke et al., 2014). Moreover, many of the proposed new projects have resulted in opposition from affected indigenous communities, which can spill over into conflict (Costa, 2014; Fleury and Almeida; 2013; Swain and Chee, 2004). These tensions arise mainly because hydropower projects in developing countries are often planned to increase energy access in urban areas, with poor consideration of their local impacts (Magee, 2006; Pearse-Smith, 2014; Duflo and Pande, 2007; Ansar et al, 2014; Sovacool et al, 2014). Magee (2006) described this phenomenon as the "powershed", given that large hydropower dams produce most benefits in urban centres far away from the dam itself.

In such contexts, knowing the priorities of dam-affected populations could help to address people's expectations and plan for unpredicted impacts. It might also help inform locally appropriate mitigation strategies (Diduck et al., 2013; Mirumachi and Torriti, 2012; Skinner et al., 2009). Despite the emphasis on stakeholder involvement in the decision making process of large hydropower projects, especially by international institutions such as the International Hydropower Association (IHA) and the World Commission on Dams (IHA, 2010; WCD, 2000), the implementation of systematic procedures to reveal social priorities is still very unusual in

developing countries (UNEP, 2007; Urban and Siciliano, 2014). It has been estimated that environmental and social safeguard processes derived from public consultations have been implemented in only 10-15% of new hydropower projects around the world (Skinner and Haas, 2014). To be effective, safeguard processes should be informed by wide public participation, through which the priorities of different stakeholders, including affected communities are disclosed (Diduck et al., 2013). To this end the article analyses the dam-affected communities' and institutional actors' perceptions of the social and environmental impacts of a large dam project following its construction and to assess the distribution of its impacts between rural and urban areas

Using the case of the Kamchay dam in Cambodia, the article asks: what are the local perceptions of the post-project social and environmental impacts? How do different stakeholders prioritise those impacts at different levels? Are positive and negative impacts evenly distributed between rural and urban areas? To address these questions the paper is structured as follows. Section 2 gives an overview of the hydropower strategies of the Cambodian government and an introduction to the Kamchay Dam and the case study area. Section 3 explains the research methods used. Section 4 discusses the results of the interviews on the perceived social and environmental impacts and the prioritization exercise carried out with local actors. Section 5 concludes the paper.

2. Case study

2.1 **Cambodia's hydropower strategy**

In Cambodia the electrification rate in urban areas is high with 97% whereas in rural areas the rate is much lower. In 2013 electricity only reached 68% of rural villages (EAC, 2014; RGC, 2013). In 2011 the energy mix showed a heavy reliance on oil products for electricity production. Oil products accounted for 90% of the total with only 4% coming from hydropower, followed by coal

and peat 3%, biofuels 2% and solar PV less than 1%. Fossil fuels are used both for transport and electricity generation. Moreover, between 1990 and 2010 Cambodia saw a decline in energy security (Sovacool et al. 2011).

Therefore, the government substantially increased investment in hydropower since 2011 (Table 1). Moreover, Cambodia plans to build more than 50 new hydropower projects (Clean Energy Info Portal, 2013; ODC, 2014). As the hydropower sector in Cambodia is still in its infancy, it is unclear if the impacts will be adequately mitigated. In relation to existing hydropower projects in Cambodia, concerns have been raised by civil society and local communities that inadequate attention is being paid to the negative impacts, while public consultation has been lacking (ODC, 2014).

TABLE 1 HERE

Although the energy production from hydropower has increased substantially in the last few years Cambodia still relies heavily on electricity imports, mainly from neighbouring countries. In 2013, imports of 2282 GWh far exceeded the domestic production of 1770 GWh (EAC, 2014). As a consequence, the cost of electricity is one of the highest in the world (IEA, 2013). According to the National Strategic Development Plan 2009-2013 (NSDP), energy is central to sustainable growth and poverty reduction in the country. Improving the power sector is one of the government's key priorities for ensuring a reliable, secure electricity supply at affordable prices (Government of Cambodia, 2010).

Given these pressures hydropower development represents the main energy priority in the country with the exploitable mid to long-term hydropower potential estimated at 1,900 MW. In the long-term Cambodia hopes to export its electricity to neighbouring countries to gain revenue.

Cambodia's Minister of Public Works and Transport, Khy Tainglim, reported this vision: "'Water is our oil […] and we should use our water to export and get foreign currency to develop the country" (cited in Goh, 2004: 7). However, issues such as environmental and safeguard processes and mitigation of the impacts have not been implemented in most of the projects, such as is the case of Kamchay Dam, to which we now turn.

2.1.1 **The Kamchay Dam**

Sinohydro, a Chinese state-owned enterprise and the world's largest dam-builder, started building the Kamchay Dam in Kampot Province, Southern Cambodia in 2006. 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. Although the expected annual output is 498 GWh, 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 dam cost an estimated US$280 million and is financed by China Export Import (ExIm) Bank as part of a US$600 million aid package to Cambodia (International Rivers, 2010).

The dam is located in a protected area on the Kamchay River in Bokor National Park, where collection of non-timber forest products (NTFPs) and community forestry are allowed by the communities settled in the park (NGO forum, 2013). Figure 1 shows the location of the dam and the 5 affected villages that we visited for the fieldwork. It is reported that the dam and the reservoir have led to the flooding of 2,015 ha of protected forest in Bokor National Park (NGO Forum, 2013) while the overall affected area is 2,291 ha which included roads and infrastructure (Urban and Siciliano, 2014). Due to the location of the dam in a national park, no resettlement was required, because there were no villages located upstream of the dam. The flooded area was previously a mixed bamboo forest, which provided raw materials for bamboo basket-making, rattan and seasonal

wild fruits, which contributed to the livelihoods of the poorer families located downstream (NGO forum, 2013).

The governance of environmental and social implications of the Kamchay Dam: a review

Bokor National Park is famous for its rich biodiversity, its forested 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 flooding of the reservoir negatively impacted on its biodiversity as species were flooded (Middleton, 2008) and no wildlife rescue operation was undertaken. Another problem was a decline in water quality, particularly during construction of the dam. The Kamchay River provides drinking water (often untreated) to the local villages and to Kampot town. The decline in water quality is particularly pronounced in the dry season, when the water may have a brownish colour and an unpleasant smell (Grimsditch, 2013). Other environmental issues are saltwater intrusion due to the dam's vicinity to the sea, erosion and changes in sediment flow downstream that can affect the fertility of soils (Grimsditch, 2013; NGO Forum, 2013), as well as changed hydrology and geomorphology.

In terms of social implications, there are four groups of people that have been directly affected by the dam: the bamboo collectors, the firewood collectors, the fruit sellers and the durian growers (Grimditch, 2012). A study conducted by NGO forum (2013), based on a survey of 100 households from communities in the affected area, analysed the positive and negative impacts on income generation and livelihood activities of the main affected groups (bamboo collectors, firewood collectors and fruit sellers) before and after dam construction. The analysis shows a positive effect, even if temporary, on firewood collectors, with an increase in the number of families collecting wood left over by the construction of the dam. By contrast, bamboo collectors and fruit sellers have experienced the greatest reductions in income as indicated in Table 2. This reduction can be attributed to the increased time and costs of collection and transportation of the bamboo and other

NTFPs. After the construction of the dam, collectors have to go further away to an area which is hardly accessible with bicycles. Therefore the majority of them need to rent motorbikes, cars and pay ferries to cross the reservoir in order to access the remaining forest. As a result, the income of 79% of bamboo-collecting families after the construction of the dam is 20,000 Riel or less per day compared to 53% prior the construction of the dam. Moreover, fruit sellers to tourists have seen their income decrease by about 28% due to the decreased number of visitors during and after the construction phase (Table 2) (NGO forum, 2013).

TABLE 2 HERE

There have been serious shortcomings with regard to the governance of the environmental and social implications of the dam. By Cambodian law, particularly the sub-decree on Environmental Impact Assessment (EIA) approved in 1999, development projects such as dams are required to have an EIA in place and approved before the construction process begins. Cambodian law also prescribed that the EIA process should be transparent, the decision-making should be accountable and a wide consultation process should involve affected local communities and civil society organisations (Middleton, 2008; NGO Forum, 2013). At the Kamchay Dam, although the EIA process started before Sinohydro began construction, approval of the final EIA was granted seven months after the inauguration of the dam (International Rivers 2012; NGO Forum, 2013). Overall, the implementation of environmental and social safeguards is minimal and not in line with Cambodian legislation (NGO Forum, 2013). In addition, verbal promises to the local population were made rather than formal arrangements in terms of energy access and livelihood diversifications. As the Kamchay dam has strategic national importance for Cambodia and was

pushed forwarded by prime minister Hun Sen himself, the Cambodian government was reluctant to follow a stricter EIA procedure as this might have delayed or halted dam constructed.

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 latter stages of dam construction. While Sinohydro is said to have set aside a so-far untouched budget of US$ 5 million for implementing mitigation measures, even high-ranking officials at the provincial Department for the Environment and the EIA office were critical of Sinohydro for its inaction, as confirmed by our interviews and other reports (NGO Forum, 2013). Moreover, the consultation processes before dam construction was patchy and ad-hoc with little local participation. Many villagers were not invited to consultation processes and only became aware of the dam once construction had started (International Rivers, 2013).

3. Methods

3.1 Local actors' identification

Local actors to be involved in the evaluation of social preferences and impacts were identified during a pilot phase in January 2014. Five villages (Snam Prampir, Moat Peam, Bat Kbal Damrei, Ou Touch, Tvi Khang Cheung) located downstream from the Kamchay Dam and affected by the dam were selected (Figure 1) based on the diversity of their main livelihoods, distinguishing among bamboo collectors, firewood collectors, durian growers and fruit sellers.

FIGURE 1 HERE

Community members to be interviewed were selected in collaboration with the village chiefs using the snowball sampling method. The snowball sampling is a non-probability sampling technique to

select subjects through the identification of an initial subject who is used to provide the names of others (Atkinson and Flint, 2001; Vogt, 1999). In each village we carried out 2 focus groups (one with men and one with women to avoid gender discrimination) using open questions. In total the FGDs involved 258 people, of which 136 were woman and 122 were men. In addition we conducted 22 individual semi-structured interviews with community members and with the chiefs (6 with woman and 16 with men). However, no significant differences between men and women were reported during the interviews. The education level of the people who participated in the FGDs and individual interviews was quite low with 66% with primary school education, 16% with lower secondary school education and 15% with no education. The age of the interviewees ranged from 18 to 75.

The main aspects addressed during the interviews and FGDs were: lifestyle changes, access to resources (water, food, energy, land, and forest products), livelihood changes, education, healthcare, involvement in the dam building decision making process, main challenges, compensation, local development, perceived environmental and ecosystem changes, and future expectations.

In addition, we undertook key informant interviews with institutional actors who had an involvement in the Kamchay Dam construction. Representatives from the NGO Forum on Cambodia, the International Union for Conservation of Nature (IUCN), the Department of Hydropower, Ministry of Industry, Mines and Energy (MIME), International Rivers, and the Kampot Provincial Department of Environment (PDoE) were interviewed on their perceptions of the socioeconomic and environmental impacts of the dam, and governance issues (referring to compensation measures, mitigation strategies, procedure for the implementation of the Environmental and Social Impact Assessment (ESIA) and the public consultation process). International organizations, such as NGO Forum, IUCN and International Rivers have mainly conducted independent studies on the effects of the dam on the environment and society. The NGO Forum on Cambodia conducted an assessment of the dam's impacts on local communities and the

environment (NGO Forum, 2013). The IUCN, which is a non-governmental global organization, valued the Bokor National Park upper forest watershed services for the Kamchay Dam hydropower scheme using damage cost avoided techniques. Modelling the increased erosion rates, accompanying soil losses and consequent delivery to the dam's storage area their study showed that failure to invest in watershed management as a component of dam maintenance could incur net costs of over $2 million in terms of power revenues (Emerton et al., 2004). International Rivers, an international NGO working on the protection of rivers and the rights of communities depending on them, has conducted a study on the appropriateness of including the Kamchay Dam in the Clean Development Mechanism (CDM) credits scheme by looking at environmental and social impacts of the dam and governance issues (International Rivers, 2012).

The governmental organizations, such as MIME and PDoE, have been directly involved in the decision making process together with Sinohydro. The Department of Hydropower in MIME is responsible for national hydropower development. In the case of Kamchay Dam, it helped to coordinate with Sinohydro regarding monitoring of the hydropower project, including the compensation process for the affected people and communities. The MIME also helped coordination between Sinohydro and sub-national and local authorities, such as the Kampot Provincial Governor, the Kampot Provincial Department of Mines and Energy, and the Kampot Provincial Department of Environment (PDoE). The latter has been directly involved in the monitoring of the water quality during all the construction phases of the dam.

3.2 Preference ranking method

To reveal social preferences and priorities linked to the social and environmental impacts of the Kamchay Dam, a preference ranking method was used. Preference ranking is a participatory technique that allows analysis and identification of problems and\or determination of the preferences and priorities of different stakeholders linked to a set of items. It can also be used to

compare perceptions, preferences and priorities of different stakeholders or groups of people (Rietbergen-McCracken and Narayan, 1998). Most applications of this method are in rural contexts and at the community level to reveal priorities and preferences in relation to livelihoods, agriculture and forestry issues, but also education, health, water and sanitation. The method is conducted in two steps. The first step is based on the identification of the main items the interviewees are confronted with in relation to one or more issues by asking them to list these items. The second step consists of the prioritization exercise. This prioritisation process can range from simple ranking in order of importance to more systematic procedures, such as the 'pairwise ranking' (Pretty et al, 1995), which was used in this study. Similar techniques, mostly used in multicriteria decision analysis, allow participants to express the relative importance of different items, usually called criteria, through the calculation of weights (Figueira and Roy, 2002; Fontana et al, 2011; Saaty, 1980; Simos, 1990a,b). To facilitate comparisons among different stakeholder rankings we used a preference ranking method called the 'Revised Simos' procedure (Figueira and Roy, 2002), which allows identification of peoples' priorities according to a set of multidimensional criteria and obtaining quantitative and ordinal weights. The procedure has been applied to different contexts, including environmental management issues (Madlener et al 2007, Kowalski et al 2009, Garmendia and Gamboa 2012). This method has been shown to be particularly suitable to facilitating critical reflection upon social preferences and perceptions in a multifaceted context, involving environmental, social, economic and institutional issues.

The items\criteria we selected for the ranking refer to the social and environmental impacts local people have experienced due to the dam construction, as well the main environmental and social issues large dams generally bring about. Therefore, the selection of the criteria was based on different sources of data and information: (i) research team experience and knowledge on large dams' impacts; (ii) analysis of the most relevant literature on the impacts of large dams in general (Bakken et al., 2014; Lerer and Scudder, 1999; McDonald-Wilmsen and Webber, 2010; Urban et al,

2013; Jackson and Sleigh, 2000; Tilt et al, 2009) and of the Kamchay dam in particular, including the analysis of the Environmental and Social Impact Assessment (ESIA) (Middleton, 2008; NGO forum, 2013; SAWAC 2011); (iii) results of the individual interviews on perceived impacts, as well as a scoping study conducted earlier. Table 3 gives an overview of the criteria used and their significance. In applying the 'Revised Simos' method, interviewees were asked to rank the criteria from the least important to the most important using 'playing cards', where each card was associated with each criterion listed in Table 3. The criteria can refer to either positive/negative impacts or changes or even to no changes according to the different experiences and perceptions of the interviewees.

TABLE 3 HERE

If the user assigns the same importance (i.e. the same weight) to some criteria, they should belong to the same subset of criteria and the same level in the ranking. Moreover, this method uses 'blank cards' to reveal the intensity of the differential importance between criteria in the ranking. Therefore, during interviews when one criterion or group of criteria were considered by the interviewee to be more important in the ranking than others, s/he was asked to express this difference using as many blank cards as s/he thought was necessary, i.e. the greater the difference the greater the number of blank cards between different criteria in the ranking. In the final step of the prioritization exercise the respondent was asked to state how many times s/he thought the last criterion was more important than the first one in the ranking. An example of the ranking obtained during the fieldwork is shown in Table 4.

TABLE 4 HERE

Once the ranking was completed and all the necessary information collected, the application of the 'Revised Simos' method computational rules made it possible to obtain quantitative weights (i.e. importance) for each criterion and from each interviewee\ranking (for more details about the computational rules deployed to obtain weights see Figueira and Roy, 2002). The weights obtained are normalized weights and their sum equals 100 such that the weights represent the perceived importance of each criterion. The use of standardised weights allowed comparisons between different rankings in a systematic way.

4. Results and Discussion

Regarding the positive and negative impacts perceived by the community members and institutional actors, our fieldwork confirmed most of the impacts and negative aspects of the dam identified by other studies previously conducted in the area and reported in Section 2.1.1. The impacts perceived by local stakeholders, broken down into positive and negative impacts, are summarised in Tables 5 and 6 and further explained in Section 4.1 and 4.2.

TABLES 5 AND 6 HERE

Regarding the prioritization exercise, which refers to how different stakeholders perceive the importance of the criteria (i.e. impacts or changes), the results are illustrated in Tables 7 and 8. The tables show the different priorities assigned to the criteria by institutional actors (Table 7) and local residents (Table 8). Each number in the table represents a weight assigned by the interviewee to a particular criterion, i.e. the higher the weight assigned to a particular criterion the higher the importance the interviewee assigns to it. The arrows in the tables indicate the type of impacts/changes the interviewees have perceived due to the dam construction: (↑)=positive impact/change; (↔)=no impact/change; (↓)=negative impact/change. The empirical findings of the

prioritization exercise are discussed in more detail hereafter, distinguishing among local residents (section 4.1) and institutional actors (section 4.2).

TABLE 7 HERE

TABLE 8 HERE

4.1 Local residents

Figure 2 and Table 8 show the results obtained from the prioritisation exercise carried out with local residents and in each village. Figure 2 is a radar chart, based on the weights displayed in Table 8 that graphically shows how people from the 5 villages prioritised the criteria. The importance attached to the criteria increases when moving from the centre to the periphery of the chart.

FIGURE 2 HERE

To give a better idea of individual weighting, the dispersion of individual weights is illustrated in Figure 3, with each point representing the weight given to a criterion by one social actor or during FGDs.

FIGURE 3 HERE

The red lines represent the mean values of the individual weights obtained for each criterion. The dispersion of the weights around the mean values reflects the degree of consensus among the people interviewed regarding the importance of each criterion. Dispersion can be also expressed using standard deviation values, which are displayed in Table 9 together with descriptive statistics of the

individual weights. Higher standard deviation values of the weights correspond to a lower consensus among the people interviewed in terms of importance attached to the criteria.

TABLE 9 HERE

The greatest differences in opinion regarding the weighting are associated with the criteria ‘changes to lifestyle’, ‘changes to livelihoods’ and ‘environmental impacts’. This is partly due to the fact that villages with different livelihood strategies did not perceive the same negative or positive impacts as discussed below and reported in Tables 5 and 8.

In Snam Prampir villagers are bamboo collectors, fruit sellers and firewood collectors; in Ou Thouch villagers rely on bamboo collection only; in Tvi Khan Cheung villagers rely on bamboo collection and for a small portion on fruits sold to tourists; people from Moat Peam and Bat Kbal Damrei are mainly durian growers. The bamboo collectors whose livelihoods depend on bamboo are the biggest group that has been affected by the dam. They generally collect bamboo to make baskets, which are sold in the local market in Kampot town. Most bamboo collectors do not have any other sources of income, many of them 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. During the interviews and the prioritization exercise villagers with poor income diversification, especially those relying on bamboo collection only, were mainly concerned about the loss of their livelihoods due to the construction of the dam due to the inundation of most of the bamboo forest area. After the construction of the dam, bamboo collectors only have access to a smaller bamboo site that is further afield. While villagers can still collect bamboo they have to stay overnight as it is far away or invest in a motorcycle to access the site. They also need to use local ferries with fee payments to cross the reservoir to reach the smaller bamboo area, which takes them longer and it is more expensive for them to collect the same amount of bamboo. This has led to a sharp decline in

incomes and a threat to livelihoods, according to the interviewed bamboo collectors. Moreover, no compensation was paid to NTFP collectors (bamboo and firewood collectors) and fruit sellers, who experienced negative impacts to their livelihoods due to the reduced access to the forest area located upstream of the dam.

Ou Touch in particular is one of the poorest villages in the area, whose villagers rely only on bamboo collection. In this village some of the community members still lack energy access due to the high costs of connecting to the power grid and the electricity itself. Accordingly, 'changes to livelihoods' mainly referred to income reduction, 'changes to lifestyle' related to the increased distance to the remaining bamboo area, and 'energy access' are the most important priorities for the members of this village. 'Livelihood changes' is the most important concern for the villagers in Tvi Khan Cheung together with 'economic opportunities' (specifically linked to livelihood diversification) for the same reasons mentioned above. Villagers from Snam Prampir rely mostly on forest products for basket production, firewood and fruit collection and have poor energy access due to the cost of electricity. 'Access to natural resources', 'changes to livelihoods', 'energy access' and 'impact on tourism' were therefore the most important concerns for the community members in this village, as the prioritization exercise illustrated in Figure 2 and Table 8.

A different perception comes from the other two villages, namely Moat Peam and Bat Kbal Damrei, which rely mostly on durian plantations and other fruits plantations. Some of the villagers received compensation by Sinohydro for land that was lost due to construction of the dam (e.g. land that was used for building roads). Moreover, Sinohydro compensated the affected families for the lost trees. The villagers reported that a lost banana tree was compensated at US$10, a mango tree at US$30, and a durian tree at $100-500 depending on size and age. The durian growing families thought this was a fair compensation payment. Some of the durian growers said they actually benefit from the dam as it reduces floods and thereby provides stable conditions for their flood-intolerant durian

trees. Consequently, some of the villagers did perceive positive impacts from the project in terms of 'impacts on flora and fauna and ecosystem changes' and 'compensation payment'. Another important aspect highlighted by the villagers in Bat Kbal Damrei was 'changes to lifestyle', which refers to better road infrastructure, though this is more of a future expectation than a direct impact from the dam construction.

Generally speaking the poorest villagers, such as from Ou Thouch, Snam Prampir and Tvi Khan Cheung, who rely heavily on forest products for their livelihoods had the shared perception that the project only brought negative economic impacts in terms of loss of income. The implementation of mitigation and social safeguard measures to assure livelihood diversification, such as the provision of long-term employment opportunities, access to energy and compensation for income reduction for those relying on NTFP collection, could do much to balance the trade-offs between the positive and negative impacts perceived by the local population.

4.2 Institutional actors

During the interviews some of the institutional actors, such as International Rivers, IUCN, NGO Forum, confirmed the negative impacts of the dam in terms of changes to livelihoods for the local people due to the reduced access to NTFPs and the presence of fewer tourists in the area (Table 7). Other respondents, such as the Kampot PDoE, reported positive impacts on fisheries production in the reservoir and the increased presence of fishermen in the area, although most of them come from outside the dam site area. Among the positive impacts from the Kamchay Dam the institutional actors, in particular governmental actors, primarily identified improved energy access in Kampot Province which is stimulating investment and local development, as well as the production of clean energy. In terms of environmental impacts the most often reported were the loss of 2,000 ha of forest located within the Bokor National Park and water pollution downstream due to construction works.

As regards governance issues, poor governance by the government and Sinohydro of the social and environmental impacts was reported by all of the institutional interviewees except The Department of Hydropower MIME. Table 6 gives an overview of the main issues regarding impacts and governance discussed during the interviews. The main problems mentioned were: (i) the lack of consultation between Sinohydro and affected communities and some of the institutional actors, such as the Kampot PDoE; (ii) the lack of implementation of mitigation strategies to address the social and environmental impacts of the dam; (iv) delay in the preparation of the ESIA report and the lack of application of international standards during its preparation by both Sinohydro and the Cambodian government (see Section 2.1.1 for an explanation of the process of preparation of the ESIA report).

Regarding the prioritization of impacts, not surprisingly formal governmental representatives expressed a similar prioritization of the positive and negative consequences of the construction of the dam. In terms of positive impacts 'economic opportunities', 'energy access' and 'production of low carbon energy' are among the most important criteria (Table 7). National electrification, low carbon energy production and economic/industrial development of Kampot Province and the national level were the most important positive aspects linked to the construction of the dam mentioned by both MIME and the Provincial Department of Environment. By contrast the NGOs - NGO Forum on Cambodia, IUCN and International Rivers - ranked 'changes to livelihoods', 'environmental impacts' and 'impact on tourism' as the most important, highlighting the negative impacts associated with these criteria. 'Energy access' to local residents was also considered important by International Rivers. This divergence between governmental and non-governmental actors on the importance of the criteria is shown in Table 10. Energy access, changes to livelihoods, economic opportunities and impact on tourism are in fact the criteria with the greatest difference in opinion about their importance (i.e. with the greatest standard deviation values).

TABLE 10 HERE

Moreover, dispersion values of institutional actors are generally much higher compared to local residents, indicating an overall weaker consensus between institutional actors over the importance of the criteria (see Tables 9 and 10).

It is also interesting to note that for MIME and the Department of Environment, the national and provincial scales of the impacts were the main focus of their prioritization, while for the other institutional actors, such as IUCN, International Rivers and NGO Forum on Cambodia, which are not governmental agencies, impacts at the local scales were considered more relevant. For instance, the IUCN representative mentioned the need to develop livelihood diversification strategies for the affected villages. Lack of compensation and loss of livelihoods, especially for NTFP collectors, was also mentioned by International Rivers as one of the most important impacts of the dam. This need to find a balance between benefits and costs at the local and national scales was evident in the responses given by the representatives of NGO Forum on Cambodia, as quoted below:

"Energy is important for the country, so the Government needs to develop an Energy Master Plan, in which each dam should be described in details including the trade-offs between social and environmental issues and the energy produced; particularly the Master Plan needs to be prioritized with a focus on benefits to local people."

Divergences between different interest groups and trade-offs among different sectors and areas, such as rural versus urban development, pose a series of policy implications in terms of environmental protection and development. From the interviews with institutional actors and affected communities one of the main issues of the Kamchay Dam, and large hydropower dams in general, is the divergence between national and local interests and priorities, which in turn bring about an unequal spatial distribution of costs (e.g. localized pollution and loss of livelihoods) and

benefits (e.g. energy access and development) between urban and rural areas, with dams being built mainly in rural areas. Large dams, especially those in developing countries, are in fact usually built to increase energy access at the national level mainly for urban development. Most, if not all, of the electricity produced by large hydropower dams is sent to big cities to promote urban development or exported to neighbouring countries, while rural areas around the dam site receive electricity from different sources (Magee, 2006; Pearse-Smith, 2014). Our analysis showed that some communities in the Kamchay Dam area still do not have access to electricity due to the high prices they have to pay to connect to the grid or because they have to buy electricity imported from other countries. To balance social and environmental gains and losses from the construction of large hydropower projects, policies must be formulated which take account of the various challenges different groups of people face before and after dam construction. The identification of those challenges through inclusive participation in the decision making process of large dam construction could help to inform the design of environmental and social safeguard processes to enhance development in both rural and urban areas. At the same time, one has to acknowledge the political and economic interests and calculi of the political and business elite that are pushing for large dam development, while knowing well that there will be social and environmental trade-offs.

5. Conclusions and Policy Implications

Hydropower development is a priority in developing countries, such as Cambodia, as a means to increase electrification rates and promote national development. However, poor consideration of local residents' priorities together with an unequal spatial distribution of trade-offs and divergences between national and local interests usually make affected communities vulnerable to the multifaceted impacts of large dams. In this regard, this paper showed how social priorities linked to the impacts of large dams are revealed using specific modes of participation. The use of broad

economic, environmental and social criteria has been useful to discover both similarities and dissimilarities between perceptions and to highlight challenges within and among different local residents and institutional actors. Moreover, the use of quantitative weights made it possible to compare preferences in a standardised way. Results showed that there is a high divergence in the prioritization of the impacts perceived by different social actors, especially between local residents and non-governmental representatives as opposed to governmental officials. This divergence over priorities refers to two distinct aspects: the scale of the impacts and the type, i.e. positive or negative.

While government officials gave a higher priority to positive economic and environmental impacts at the national or provincial scales, local residents and non-governmental organizations highlighted the socioeconomic costs to the affected communities and the environment around the dam site as the most important issues which need to be addressed by the implementation of proper mitigation strategies. Balancing national and local interests and priorities is one of the main issues related to the uneven distribution of benefits and negative externalities in dam construction, since proper compensation for the losses or mitigation strategies are rarely effectively implemented (UNEP, 2007).

While in most of the cases of large dams built in developing countries, the electricity produced is almost entirely exported to big cities, local environmental and social impacts and the challenges local residents experience after and during the construction of such large projects are largely overlooked by central government, builders, developers and financiers. In the case of the Kamchay Dam most of the villages are still facing problems in terms of livelihood losses without receiving adequate or any compensation. Moreover, many of the benefits from the construction of the dam promised by the builders and the government to the local population during consultation meetings have not been fulfilled. This is partially due to the fact that the EIA report does not provide any

specific social safeguard measures to address the diverse impacts on the local population, including livelihood diversification strategies and measures to promote local development. In addition, verbal promises were made rather than formal arrangements.

The above considerations lead to the first policy proposition of this paper. **Policy proposition 1:** *For an effective and balanced decision-making process of large-scale hydropower projects, national and local priorities should be harmonized and given the same importance in all the phases of dams' construction, i.e. design, implementation, monitoring and mitigation. This should be done by including local priorities and challenges in the preparation of an Environmental and Social Impact Assessment (ESIA) which specifically identifies social safeguard measures that not only compensate local populations for losses of specific assets but also promote local development.* This point is particularly relevant for organisations carrying out the ESIAs, such as consultancies, and for national and local governments for monitoring purposes.

The lack of proper public consultation processes makes the recognition by policy makers of the real impacts of the projects on the local population before and after construction very difficult and often not complete. The use of these methods, as shown in this paper, could help to balance gains and losses at different scales. The prioritization exercise revealed that villages with different livelihood strategies also have different priorities and perceptions of the impacts of the project. Ad hoc and diversified policy measures should be developed to mitigate the impacts according to the various challenges different groups of people face before and after dam construction. Compensation measures should also be designed according to different types of losses which usually accompany the loss of land due to construction works. In the case of Kamchay Dam, most communities' livelihoods depend on forest products from land to which they do not have property rights. Therefore they did not receive compensation for losses due to the flooding of part of the forest, nor did they receive support for livelihood diversification. Knowing the prioritization strategy of social

actors in relation to the multifaceted impacts of large dams can provide useful insights to policy-makers for the design of mitigation strategies in line with the needs of differently affected people. The above considerations lead to the second policy proposition of this paper. **Policy proposition 2:** *To achieve effective development outcomes, public consultation should (i) be based on established participatory methods; (ii) include all the relevant stakeholders at different levels: national, regional and local; (iii) be able to differentiate challenges according to different groups of affected people and relate to conditions before and after dam construction.* This point is particularly relevant for dam-building firms and national and local governments.

Moreover, a positive outcome of large dams' construction requires several enabling conditions, such as "supporting legislation, a combination of land and non-land based sustainable livelihood provisions, strong community participation and accountability and commitment from government and project developers" (WCD, 2000: p. 109). While there has been growing emphasis on transparency and participation in decision-making surrounding large dams, actual change in practice remains slow, as demonstrated by the Kamchay Dam. Similar cases have been reported in relation to other large dams, such as the Bakun Dam in Malaysia and two hydroelectric projects in Uttarakhand in India (Diduck e al., 2013; Stephenson, 2014).

Active participation of different affected people is therefore recommended to enable people to cope with the complexity and diversity of the impacts of large dams, the unbalanced spatial distribution of costs and benefits between urban and rural areas and national versus local interests, and to enhance the elaboration and implementation of social mitigation and development measures. Moreover, the development of specific national energy policies and legislation on hydropower which support the implementation of social and environmental safeguard processes and open decision making are crucial to ensure that the large dams sector is developed in a way that minimizes social and environmental harm. This could be dealt with similarly to other controversial

energy developments, such as fracking, for which some countries have specific national legislation. In addition, large dams are different to other infrastructure developments such as roads or housing as they can have large-scale social and environmental impacts that may include the resettlement of large numbers of people, the loss of livelihoods for affected people, the destruction of river ecosystems upstream and downstream, and potential trans-boundary effects etc. This goes beyond what is usually covered in conventional energy policy and EIA legislations. The above considerations lead to the third and last policy proposition of this paper. **Policy proposition 3:** *There is a need for the development of specific national energy policies and legislation on hydropower that include safeguard processes and open decision making to cope with the many social and environmental challenges large dams bring about.* This point is particularly relevant for national governments.

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Table 1 Generation Facilities and Energy produced: classification by Generation Type

Type of Generation	Installed Capacity, kW		Proportion of Installed Grid Capacity in % for 2013	Energy produced, Million kWh		Proportion of Energy produced in % for 2013
	Year 2012	Year 2013		Year 2012	Year 2013	
Hydropower	225,430	682,100	59.06	517.37	1,015.54	57.38
Diesel/Heavy Fuel Oil	321,005	325,323	28.17	856.563	578.99	32.71
Wood, other bio mass	22,500	14,570	1.26	11.747	6.68	0.38
Coal	13,000	133,000	11.52	37.42	168.75	9.53
Total	581,935	1,154,993	100	1,423.1	1,769.96	100

Source: EAC, 2014

Table 2 Livelihood strategies and income changes before and after the dam's construction

Livelihood strategies	Impacts	
	Before	After
Bamboo collectors	- 97% using bicycle to collect bamboo - 47% of the families earned more than 20,000 Riel and 53% less than 20,000 Riel per day	- 33% using bicycle to collect bamboo - 21% earn more than 20,000 Riel and 79% earn less than 20,000 Riel per day
Firewood collectors	- 20 to 30 families collecting wood along the road from Kampot to the dam area	- More than 50 families collecting wood along the road from Kampot to the dam area (temporary condition- logs left in the reservoir)
Fruit sellers for tourists	- 19% collected NTFPs other than bamboo including fruits - 86% earned more than 30,000 Riel and 14% earned less than 30,000 Riel per day - Tourists: 278,000 in 2006	- 2.5% collect NTFPs other than bamboo including fruits - 23% earn more than 30,000 Riel and 77% earn less than 30,000 Riel per day - Tourists: 65,000 in 2011

Source: NGO forum, 2013

Table 3 Criteria and their significance*

Criteria	Significance
Tourism	- impacts on tourists' presence in the area
Economic development/opportunities	- financial benefits from dam building and operation - impacts on business opportunities

	- impacts on investments
Changes to livelihoods	- changes in income generation activities - farming, fishing, trading, bamboo collection, and animal husbandry - impacts on income
Compensation payments	- management of compensation measures - lack of compensation
Employment	- impacts on local employment and opportunities, such as access to new jobs
Production of low-carbon energy	- carbon offsetting - Clean Development Mechanisms (CDM) - abatement of greenhouse emissions
Environmental impacts (changes to flora, fauna, hydrology, geomorphology and ecosystem changes)	- changes in fish productivity and fish population - changes to water quality and water flow - changes to geomorphology and landscape - impacts on endangered species
Access to natural resources for livelihoods and food security	- impacts on access to water, forest, land, fisheries
Changes to lifestyle	- impacts on access to markets - impacts on access to healthcare centres - impacts on access to schools - impacts on social cohesion/ social relations - quality of resettlement, housing and infrastructures
Energy access	- impacts on energy access for the local population and economic activities in the area - impacts on energy security at the national level

* Impacts or changes can be either positive or negative depending on the experience and perception of the interviewees.

Table 4 Example of a preference ranking in ascending order – interview with the Department of the Environment at the provincial level in Kampot

Rank	Subset of *ex aequo*	Number of cards according to the rank
1	Impact on tourism; Access to natural resources	2
2	Employment	1
3	Compensation; Environmental impacts	2
4	Changes to livelihoods	1
5	Changes to lifestyle	1
6	Energy access	1
7	Production of low carbon energy	1
8	Blank cards (2)	2
10	Economic opportunities	1

Table 5 Livelihood strategies and impacts – local communities

Livelihood strategies	Impacts	
	Positive	**Negative**
Bamboo collectors	- No positive impacts were reported during the interview with bamboo collectors	- Loss of part of the bamboo collection area due to flooding - Restriction of the access to the bamboo forest

		located on the other side of the reservoir due to the introduction of a ban which doesn't allow the use of engine boats - Lack of compensation to bamboo collectors for income loss during the closure of the bamboo forest area due to construction works - Increased competition over the use of the bamboo resource. Many bamboo collectors can produce fewer bamboo baskets now and are experiencing extreme financial hardship (particularly the case for the villagers in Ou Touch who do not own any land or have any other sources of income).
Firewood collectors	- During dam construction some livelihood increased due to the collection of the wood left over by the deforestation process and easy access to the area thanks to the construction of a new road by Sinohydro.	- After the construction of the dam, a ban to access part of the forest area, as well as to use trucks and engine boats to cross the reservoir. This has significantly reduced the amount of wood that the villagers can collect compared to before the dam construction works begun.
Durian growers	- Positive impacts for durian workers: before the construction of the dam frequent floods killed some of the durian trees. After the construction of the dam, flood control has helped to protect durian plantations.	- No negative impacts were reported during the interview with durian growers
Fruit sellers	- No positive impacts were reported during the interview with bamboo collectors	- Livelihoods of fruit sellers have been adversely affected by the dam. After the dam construction the river is dry most of the time and 80% of the tourists have disappeared. The income of the fruit sellers has therefore declined by 80% too (as reported by FGDs with fruit sellers)

Table 6 Impacts, mitigation and consultation processes – main positive and negative issues identified by institutional actors

Main issues	**Impacts and management strategies**	
	Positive	**Negative**
Impacts		
Social	- Improved energy access in Kampot province and at the national level - Improved local development in Kampot province, better roads, new infrastructures and hotels	- Changes to livelihood strategies due to flooding and denied access to the remaining bamboo area - Reduced access to natural resources
Environmental	- Production of clean energy and carbon offsetting	- Impacts on biodiversity – endangered species and the forest (2,000 ha of forest inundated within Bokor National Park) - Water pollution downstream due to the flow of construction materials from upstream
Economic	- Increased fisheries activities in the reservoir	- Impacts on tourism, less tourists in the area due to reduced water flow downstream

			- Loss of livelihoods for bamboo and non-timber forest product-NTFP collectors
Governance			
Mitigation	-	No positive aspects were reported during the interview	- Lack of implementation of mitigation strategies for environmental and social impacts - Ineffective and non-transparent communication process between the Cambodian authorities and dam builders (i.e. Sinohydro) on responsibility of impact mitigation
Consultation	-	No positive aspects were reported during the interview	- Poor consultation with local and national institutions regarding the development of the ESIA and compensation issues - Lack of consultation with affected villagers regarding compensation issues and mitigation strategies
Compensation	-	No positive aspects were reported during the interview	- Compensation only provided to some of the affected villagers - no compensation provided to NTFP collectors
Assessment of environmental and social impacts	-	No positive aspects were reported during the interview	- The ESIA was carried out and finalized after the construction of the dam started

Table 7 Weights of criteria according to institutional actors' priorities

Criteria	Department of Environment	NGO Forum	IUCN	International Rivers	MIME
Access to natural resources for livelihoods and food security	5.9(↓)	12.7(↓)	1.05(↓)	10.9(↓)	5.5(↓)
Changes to lifestyles	11.2(↔)	10.9(↔)	4.2(↔)	9.1(↔)	3.6(↔)
Changes to livelihoods	9.9(↓)	14.5(↓)	15.8(↓)	14.5(↓)	1.8(↓)
Compensation payment	8.6(↑)	1.8(↓)	12.6(↓)	12.7(↓)	14.5(↑)
Economic opportunities	16.4(↑)	7.3(↔)	7.4(↔)	3.6(↔)	18.2(↑)
Employment	7.2(↑)	5.5(↔)	9.5(↔)	1.8(↔)	10.9(↑)
Energy access	12.5(↑)	3.6(↔)	6.3(↔)	18.2(↔)	16.4(↑)
Impact on tourism	5.9(↓)	18.2(↓)	16.8(↓)	7.3(↓)	7.3(↓)
Environmental impacts	8.6(↓)	16.4(↓)	17.9(↓)	16.4(↓)	9.1(↓)
Production of low carbon energy	13.8(↑)	9.1(↑)	8.4(↑)	5.5(↑)	12.7(↑)

Note: The arrows in the table indicate the type of impacts/changes the interviewees have perceived due to the construction of the dam, as follows: (↑)=positive impact/change; (↔)=no positive or negative impact/change; (↓)=negative impact/change

Table 8 Weights of criteria according to local residents from the five villages interviewed[1]

	Snam Prampir	Tvi Khan Cheung	Ou Touch	Moat Peam	Bat Kbal Damrei

[1] The results for each village are an aggregation (i.e. mean) of the weights obtained by individual interviews and focus group discussions.

Access to natural resources for livelihoods and food security	15.7(↓)	8.5(↓)	9.2(↓)	7.0(↔)	6.6(↔)
Changes to lifestyles	6.1(↓)	9.2(↓)	16.7(↓)	7.0(↔)	17.9(↑)
Changes to livelihoods	11.8(↓)	15.1(↓)	21.0(↓)	7.0(↑)	6.6(↑)
Compensation payment	6.1(↓)	8.1(↓)	7.0(↓)	14.0(↑)	6.6(↑)
Economic opportunities	11.0(↔)	11.6(↔)	7.0(↔)	10.5(↔)	10.4(↔)
Employment	12.2(↔)	10.0(↔)	7.0(↔)	10.5(↔)	10.4(↔)
Energy access	13.7(↔)	11.0(↔)	9.7(↔)	8.8(↔)	8.5(↔)
Impact on tourism	12.2(↓)	8.4(↓)	7.0(↔)	7.0(↔)	6.6(↔)
Impacts on flora and fauna and ecosystem changes	5.6(↓)	11.1(↓)	7.0(↓)	21.1(↑)	19.8(↑)
Production of low carbon energy	5.5(↑)	7.1(↑)	8.6(↑)	7.0(↑)	6.6(↑)

Note: The arrows in the table indicate the type of impacts/changes the interviewees have perceived due to the construction of the dam, as follows: (↑)=positive impact/change; (↔)=no positive or negative impact/change; (↓)=negative impact/change

Table 9 Descriptive statistics of individual weights from local residents

Criteria	Mean	Standard deviation	Max	Min
Access to natural resources	9.4	3.7	15.7	6.6
Changes to lifestyles	11.4	5.5	17.9	6.1
Changes to livelihoods	12.3	6.0	21.0	6.6
Compensation payment	8.4	3.3	14.0	6.1
Economic opportunities	10.1	1.8	11.6	7.0
Employment	10.0	1.9	12.2	7.0
Energy access	10.3	2.1	13.7	8.5
Impact on tourism	8.2	2.3	12.2	6.6
Environmental impacts	12.9	7.2	21.1	5.6
Production of low carbon energy	7.0	1.1	8.6	5.5

Table 10 Descriptive statistics of individual weights from institutional actors

Criteria	Mean	Standard deviation	Max	Min
Access to natural resources	7.2	4.7	12.7	1.1
Changes to lifestyles	7.8	3.6	11.2	3.6
Changes to livelihoods	11.3	5.8	15.8	1.8
Compensation payment	10.1	5.1	14.5	1.8
Economic opportunities	10.6	6.4	18.2	3.6
Employment	7.0	3.6	10.9	1.8
Energy access	11.4	6.3	18.2	3.6
Impact on tourism	11.1	5.9	18.2	5.9
Environmental impacts	13.7	4.5	17.9	8.6
Production of low carbon energy	9.9	3.4	13.8	5.5

Figure 1

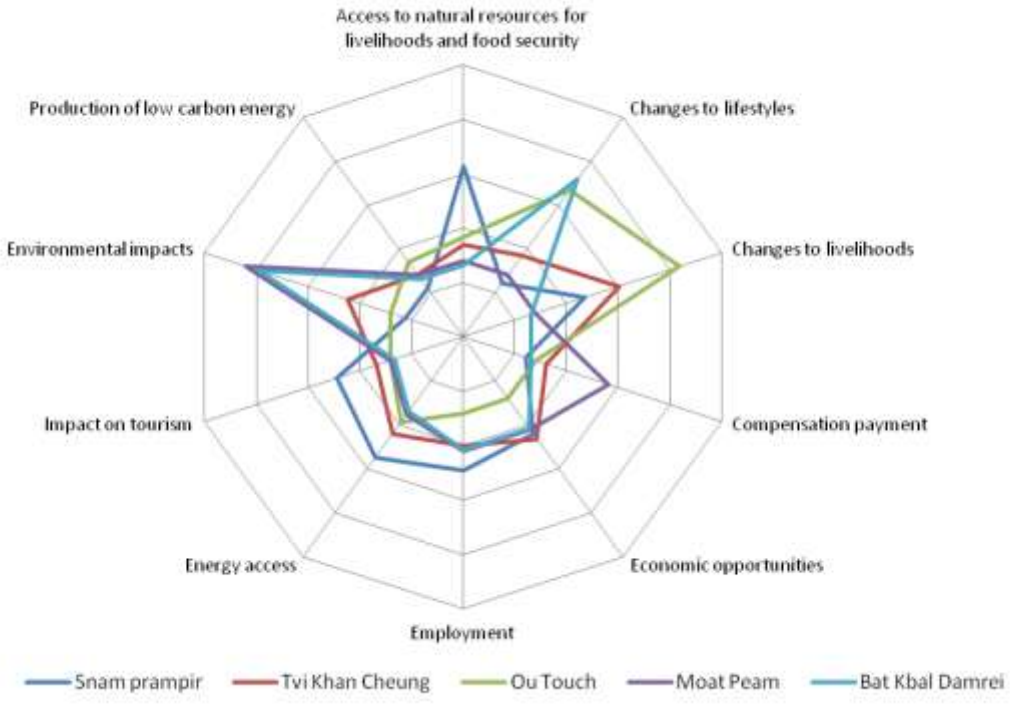

Figure 2

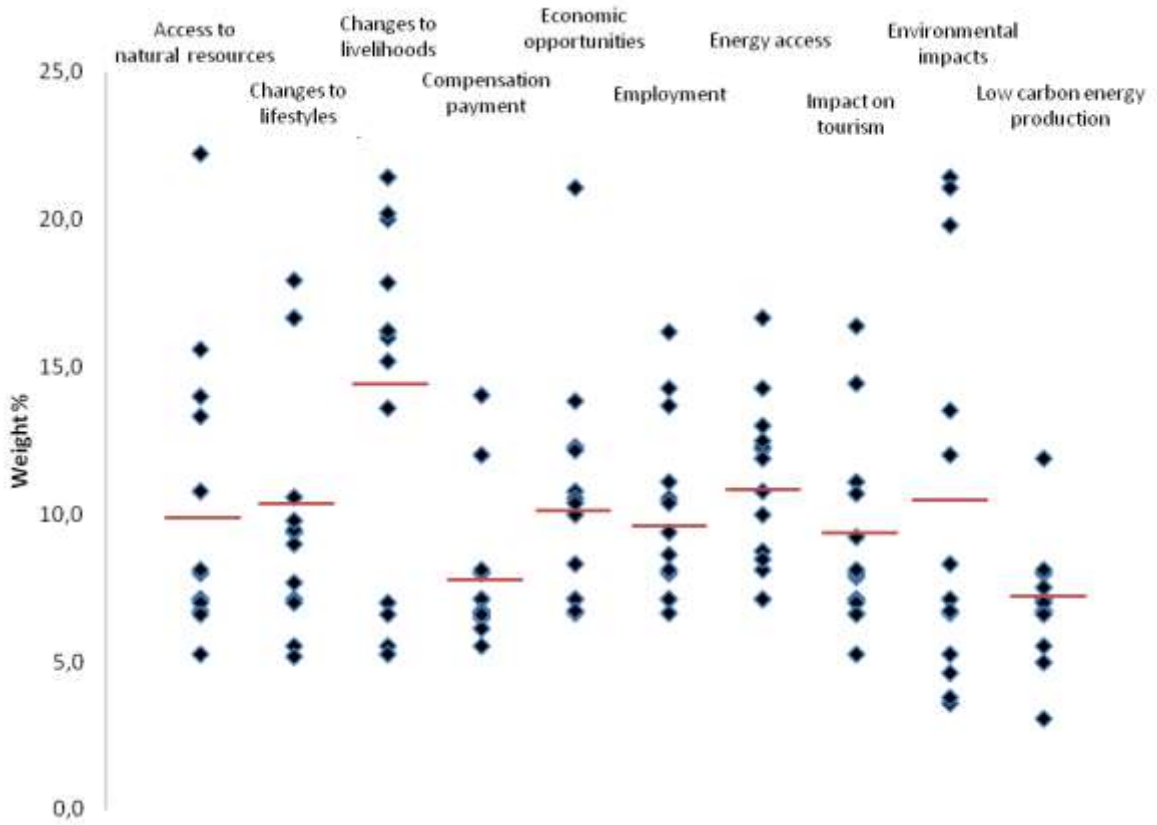
Access to natural resources
Changes to lifestyles
Changes to livelihoods
Compensation payment
Economic opportunities
Employment
Energy access
Impact on tourism
Environmental impacts
Low carbon energy production
Weight %
25,0
20,0
15,0
10,0
5,0
0,0

Figure 3