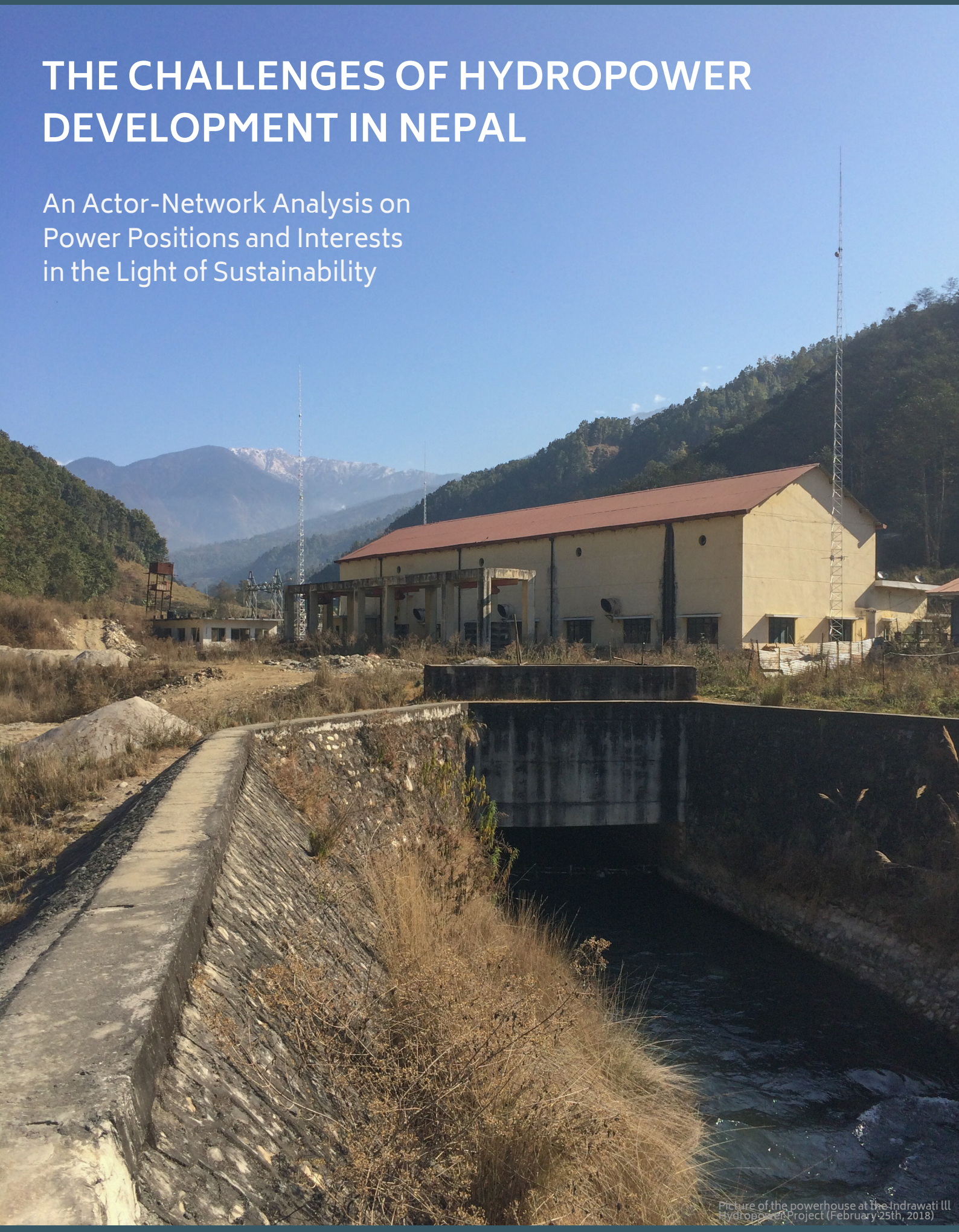
THE CHALLENGES OF HYDROPOWER DEVELOPMENT IN NEPAL

An Actor-Network Analysis on Power Positions and Interests in the Light of Sustainability



Picture of the powerhouse at the Indrawati lll Hydropower Project (February 25th, 2018)

Master Thesis in Techno-Anthropology
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Abstract

The Nepali government has identified that hydropower (HP) should secure its rightful place as a driving force of the national economy. In the process of expanding the Nepali HP sector, a legislative framework has been put in place to reduce environmental impacts through, among other things, public engagement. This framework demands an HP company to conduct environmental assessments studies of an HP project and enclose them in a report. Such a report is known as either an *Initial Environmental Examination* (IEE) or an *Environmental Impact Assessment* (EIA). Although, this framework is in place several studies argue that the ecosystem along with citizens in HP areas suffer from HP development (Munch-Petersen, 2017; Lord, 2014; Sovacool et al., 2011).

This thesis takes a point of departure in IEE and EIA reports and the guidelines framing them in order to unfold the dynamics of the HP landscape in Nepal from a socio-technical perspective. The objective is to produce a set of recommendations in order to augment current assessment guidelines. *Actor-network theory* constitutes the framework of the thesis. We draw on concepts such as *matters of concern* (Latour, 2005a) and *translation processes* (Callon, 1986) as this constitutes a rich perspective for understanding power structures of an actor-network. A deconstruction of such power structures has opened up black boxed knowledge surrounding HP and unveiled how the interests of some actors have been displaced or even neglected. Ethnographic and digital methods have been applied to acquire both quantitative and qualitative data, which has been used to present a qualitative analysis of HP networks. Concretely, these methods include participant observation and semi-structured interviews which have been applied in two case studies. Furthermore, it includes digitally harvested data of website hyperlinks and article citation networks.

The overall findings suggest that there is a disconnect between what is stated in the impact assessment reports and that which is experienced by those local to HP projects. A legislative framing, in the form of guidelines for IEE and EIA reports, is insufficient when government authorities choose to ignore legislation set by themselves. Such lack of accountability is most blatantly seen in an almost total lack of HP monitorisation. We advocate for a move beyond legislation by recommending a mobilisation of actors, who possess both motivation and agency to advocate for sustainable change. In this context, sustainability should be understood as access for all concerned actors to engage in the HP network and to voice their concerns.

Keywords: *actor-network theory; matters of concern; translation process; public engagement; digital methods; environmental impact assessment; hydropower*

Resumé

Dette kandidatspeciale behandler forskellige problemstillinger forbundet med opførelsen af vandkraftværker i Nepal. Baggrunden for dette er, at myndighederne i Nepal har identificeret vand som landets vigtigste naturressource, idet det kan udnyttes til vandkraft. Elektricitet igennem vandkraft betegnes af myndighederne i Nepal, som et af de vigtigste midler til at løfte landet ud af fattigdom. For at sikre en bæredygtig udvidelse af vandkraft-sektoren er en lov vedtaget, der blandt andet indebærer, at alle kommercielle vandkraftværker skal leve op til en række retningslinjer. På baggrund af disse retningslinjer skal energiselskaber foretage studier omhandlende potentielle miljømæssige, sociale og kulturelle påvirkninger, der er forbundet med opførelsen og driften af vandkraftværker. Det er derudover påkrævet energiselskaber at beskriv, hvilke forholdsregler de vil implementere for at modvirke sådanne påvirkninger. Dette er ofte en lang proces, blandt andet fordi der stilles krav til borgerinddragelse i forskellige faser af studierne. Studierne skal munde ud i en samlet rapport, som skal godkendes af de nepalesiske myndigheder inden opførelse af et vandkraftværk.

Flere studier har imidlertid påvist, at både miljø og dele af den nepalesiske befolkning er negativt påvirket som følge af opførelsen af vandkraftværker (Munch-Petersen, 2017; Lord, 2014; Sovacool et al., 2011), hvilket indikerer, at de nuværende retningslinjer ikke har den intenderede effekt. Dette kandidatspeciale har derfor til formål at undersøge, hvordan de nuværende retningslinjer kan forbedres med henblik på at etablere en bæredygtig udvikling for fremtiden. Med udgangspunkt i disse retningslinjer og med en teoretisk ramme og perspektiv bestående af aktør-netværk teori (ANT) analyserer dette kandidatspeciale de dynamikker, der udspiller sig i et aktør-netværk fra et socio-tekniske perspektiv. Dette operationaliseres blandt andet med brugen af ANT-begreberne: *matters of concern* (Latour, 2005a) og *translationsprocesser* (Callon, 1986). Førstnævnte begreb har til formål at belyse de mange synspunkter, der samler sig omkring viden, der har stabiliseret sig som fakta. Sidstnævnte begreb er blevet brugt til at dekonstruere netværk af aktører, der i samlet flok værner om et faktum. Det empiriske fundament for dette kandidatspeciale består af kvalitativ etnografisk data, der er indsamlet ud fra to casestudier. Hvert af de to casestudier er i form af et nepalesisk energiselskab og dets vandkraftværker. Metodisk er dataene indhentet via deltagende observation og semi-strukturerede interviews. Herudover er der indsamlet kvantitativ data ved brug af en række digitale værktøjer. Denne data er inddelt i to datasæt, hvor det ene består af hyperlinks mellem hjemmesider, og det andet består af et citationsnetværk af akademiske artikler. Den digitale, såvel som den analoge, data har indgået i kvalitative netværksanalyser, der har haft til formål at komplimentere hinanden.

Denne analyse viser, at der er et misforhold mellem, på den ene side, indholdet af de rapporter, som energiselskaber bliver pålagt at skrive forud for opførelsen af vandkraftværker, og, på den anden side, den virkelighed som udspiller sig i praksis. I nogle tilfælde er det kun talspersoner for den berørte lokalbefolkning, der tager del i borgerinddragelsesprocesser, og i andre tilfælde finder sådanne processer slet ikke sted. Analysen viser derudover, at myndighederne bevidst forsømmer deres formelle ansvar, som består i at monitorere vandkraftværker, der er under opførelse, samt dem der allerede er i drift. Der er således en ansvarsfralæggelse i forhold til gældende retningslinjer blandt både energiselskaber, og de myndigheder som bør kontrollere, at retningslinjerne bliver overholdt. Dette peger alt sammen i retning af en overordnet problemstilling omhandlende interessen i vand versus interessen i elektricitet.

En forbedring af de nuværende retningslinjer kan ikke finde sted på baggrund af lovmæssige ændringer, eftersom at myndighederne ikke selv overholder disse love. Konklusionen er derfor, at forbedringer bør ske via et pres fra aktører, som både har motivation og handlekraft til at skabe forandringer. De følgende anbefalinger bygger således på et grundlag, der sætter sig ud over lovgivning. Begrebet 'bæredygtighed' skal i denne kontekst redefineres og i stedet forstås som tilgangen til beslutningsprocesserne for alle aktører. En sådan tilgang kan skabes igennem en mobilisering af investorer, som har en interesse i at opretholde en respektabel CSR-profil udadtil. Disse investorer er ofte finansielle *gatekeepers* for vandkraftprojekter. Derudover bør NGO'er i højere grad involvere sig i vandkraftsektoren, da de kan agere bindeled mellem energiselskaber og lokalbefolkning, facilitere øget borgerinddragelse samt sikre at monitorering finder sted. Sidst men ikke mindst har en nepalesiske interesseorganisation for private energiselskaber og investorer, med akronymet IPPAN, udtrykt utilfredshed med manglende monitorering. Denne organisation kan med sin samlede handlekraft advokere for bedre monitorering, ved at udvide sit nuværende interesseområde.

Contents

Preface

The backbone of this thesis project is not surprisingly the empirical data gathered in various places of Nepal, but for Nepal to become the place for our field study was not at all the plan to begin with. Right before Christmas, 2017, we felt confident that we would be granted access to conduct fieldwork on the subject of hydropower development near Vientiane in Laos. For different reasons the project fell apart in late January, 2018. As time was suddenly of the essence we were very grateful to be granted access by the end of January to conduct fieldwork at National Hydro Power Company in Nepal. Not long after that, we also acquired access to conduct fieldwork at Butwal Power Company. In other words, we literally went from having no project at all to two weeks later finding ourselves on an airplane heading for Kathmandu with an accepted project proposal by both companies.

We would like to thank all the staff of National Hydro Power Company and Butwal Power Company who participated in our research. Special thanks go to Mr. Kumar Pandey and Mr. Pratik Man Singh Pradhan who were responsible for granting us access to the respective companies and essentially allowing this thesis to materialise. Furthermore, a great amount of gratitude goes to Sudip Lama whose tireless work as our primary interpreter helped unravel much of the complexity in our research. Last, but by no means least, we would like to thank all the local Nepalis who took their time to speak to us and make us feel welcome in their country.

Acronyms

AHPP: the Andhikola HydroPower Project
ANT: Actor-Network Theory
BPC: Butwal Power Company
DoED: Department of Electricity Development
EIA: Environmental Impact Assessment
EMP: Environmental Management Plan
EPA: Environment Protection Act
EPR: Environment Protection Rules
HCE: Hydro-Consult Engineering
HDP: the Hydropower Development Policy
HP: HydroPower
IEE: Initial Environmental Examination
IHA: International Hydropower Association
IHPP: the Indrawati lll HydroPower Project
IPPAN: Independent Power Producers' Association, Nepal
LIHPP: the Lower Indrawati HydroPower Project
MoC: Matters of Concern
MoF: Matter of Fact
NHPC: National Hydro Power Company
NEA: Nepal Electricity Authority
NEIAG: National Environmental Impact Assessment Guidelines
OPP: Obligatory Passage Point
PPA: Power Purchase Agreement
ToR: Terms of Reference
VDC: Village Development Committee

1. Introduction

Nepal has attempted to lift itself out of its civil war from 1996 to 2006 (Lawoti, 2009, pp. 3-23) and the resulting political turmoil, only to be struck by natural disaster during the devastating 2015 earthquake that lead to yet more political disruption. Throughout these times of hardship, it was identified by Nepali governments that hydropower (HP) should secure its rightful place as a driving force of the national economy to enrich the country as a whole (Lord, 2014, p. 112). Increasing investment in HP is believed to pave way for Nepal's energy sovereignty outside foreign influence (Sharma and Awal, 2013, pp. 690-691). Undoubtedly, a huge HP potential looms in Nepal which the Himalayan mountain bare testament to and furthermore this promise is needed as electricity demand has more than doubled since 2004 (Lord, p. 112). There are many obvious benefits and possibilities in HP including: infrastructure electricity, jobs, irrigation, corporate funding of local institutions, and not least the fact that HP is both a green and renewable source of energy. The late Dr. Hari Man Shrestha's assessment, produced during his research work in 1966, estimated the Nepali HP potential to be 83,000 MW. This number is still echoed today, however, only one percent of the 83.000 MW is currently being exploited (Sovacool et al., 2011, pp. 3469).

As a result of a growing HP sector in Nepal and multiple HP projects in the pipeline, there is a risk that a part of the population and the ecosystem will suffer from a strong political ambition of energy sovereignty in a country where the political landscape is still in the gestation phase of becoming stable (Koirala, Hill and Morgan, 2017, pp. 112-113; Sovacool et al., 2011, pp. 3471). Although, HP is considered environmentally friendly it does not come without environmental impacts (i.e. social, cultural and natural), which is why the government of Nepal has produced three very essential documents: *National Environmental Impact Assessment Guidelines* (NEIAG), *Environment Protection Act* (EPA), and *Environment Protection Rules* (EPR). These three documents constitute the legislative framing of HP development with the overall objective of securing sustainability. In connection to that, HP companies are required to conduct various impact assessments and publish them in reports known as *Environmental Impact Assessment* (EIA) and *Initial Environmental Examination* (IEE). These reports have to be approved by government authorities prior to any construction work. Whether an HP project qualify for an EIA or an IEE depends on different factors such as the power capacity of the HP plant, the chosen location (national park, farmland, conservation areas, etc.), amount of deforestation to carry out, and/or whether resettlement of local people is required. Whereas an IEE is an analytical study an evaluation of potential adverse environmental impacts summarised in a list of *terms of reference* (*ToR*), an EIA is a much more detailed investigation which require the HP

company to engage the public in hearings, workshops, focus groups, etc. at different stages throughout conducting the study. Furthermore, the HP company shall formulate an *environmental management plan* (EMP) that describes exact mitigation measures to be implemented in order to combat various environmental impacts (Department of Electricity Development, 1997; National Conservation Strategy Implementation Project, 1993).

The focal point of this thesis is on the EIAs and IEEs as these are the reports, which HP companies are held accountable to throughout the phases of an HP project. We are interested in investigating into the ways in which different stakeholders in the Nepali HP sector address both of these frameworks. This is followed by unravelling the motivations and incentives, which dominate HP development as well as the challenges and issues that are associated with such. Thus, the overall theme revolves around the notion of *public engagement* in HP development. This interest was generated on the basis of recent studies indicating severe inconsistencies within the HP sector in Nepal. Specifically, illustrating that despite local people being invited by HP companies to participate throughout the phases of HP construction, issues do continue to persist in terms of how public engagement is carried out. This is reflected in the deprived dissemination of public participatory rights as the public is mostly being 'guided' by proponents of HP (Koirala, Hill and Morgan, 2017, pp. 113-114; Munch-Petersen, 2017, pp. 17-21). In particular, the study by Jon Munch-Petersen (2017) has been a great inspiration for this research to form an enquiry based on some of his recommendations that seek to strengthen the legislative framework for EIA reports.

In order to commence such an investigation, we have opted for the theoretical framework of *actor-network theory* (ANT) by mainly drawing on thoughts developed by Michelle Callon and Bruno Latour. In regards to the former, we will make use of Callon's *moments of translation* to understand how heterogeneous actors form in networks (Callon, 1986). In these networks, we see the presence of what Latour describes as *Matters of Facts* (MoF) (Latour and Woolgar, 1986). These MoFs may be perceived as black boxed uncontested claims, which have reached such a position upon a process of negotiations wherein these assertions are stabilised as MoFs. In order to acquire an understanding of how MoFs are formed, we will adopt the notion of *second-degree objectivity* that serves to illuminate the multitude of *matters of concerns* (MoC) found in the network on the basis of controversy (Venturini, n.d.; Latour, 2005a). This idea revolves around the concept of viewing a single phenomenon, such as environmental impacts, from multiple viewpoints, and thereby, acquiring an understanding of individual actors' concerns. In other words, it is the effort of considering "(...) as much subjectivity as possible." (Venturini, 2010a, p. 270).

The empirical foundation of this thesis is data gathered in Nepal over the course of two months. Most of the data origins from two case studies. The first case is framed around the Andhikola HP Project (AHPP) owned by Butwal Power Company (BPC). The second case is framed around the Indrawati lll HP Project (IHPP) along with Lower Indrawati HP Project (LIHPP), which is owned by National Hydro Power Company (NHPC). Data has been acquired through participant observations and through semi-structured interviews, sometimes with the aid of interpreters. With an outset in these two cases, we will try two unfold some of the hegemonic black boxed MoFs that exists in the HP sector in Nepal. In this process, we have defined a set of main actors. Those citizens who feel negatively impacted by HP projects will, henceforward, be referred to as *the concerned public*. Such terminology is preferred to avoid any a priori demarcation of who is included in this group (or groups) of people. We will use the term *HP developer* as an umbrella term for those corporate actors, who actively take part in the materialisation of HP projects (i.e. investors, HP consultancies, and HP companies along with their subsidiaries). Moreover, we have defined the ecosystem as an actor along with the government which we have already touched upon. These four actors constitute the key figures of the Nepali HP network. However, it is important to understand that these actors are not fixed in ironbound positions, as networks, from an ANT perspective, are dynamic in nature. Methodologically, we will sustain and elaborate on this idea of networks by using digital tools to create network maps based on digitally harvested data. This allows us to view our offline actors in an online context and to investigate the influence of science in HP development from a socio-technical perspective. Such perspectives will provide new understandings to the subject of sustainable HP development.

2. Research Question

First and foremost, this thesis aims to bring forth perceptions of the concerned public who in any way are impacted by HP projects since they are often disenfranchised or at the very least marginalised due to being of low cast, being poorly educated, or living under the poverty line. We have already stated that an assessment report, either in the form of an IEE or an EIA, is mandatory prior to commencing construction work, as it should comprise all expected environmental considerations. These reports may be written by anyone affiliated with HP projects as there are no requirements for the reports to be written by independent assessment agencies. This bias is merely one thing, which hamper sustainable HP development. In addition, the media has for years problematised HP, most recently in February 2018 when *The Record* (an online news agency based in Kathmandu) touched upon one of the issues: “Hydropower development is often presented as an unequivocal boon for Nepal. But its impact on people who live in hydro project areas has received little attention” (The Record, 2018). The issues are, thus, not only connected to the planning phase and the construction phase, but also to the operationalisation phase. On the basis of these revelations our research question is as follows:

> ***How may impact assessment guidelines connected to hydropower development be augmented in a manner which creates a sustainable foundation for the ongoing development of hydropower in Nepal?***

In order to make such recommendations it is not only prudent, but also more valuable to understand the inner and outer workings of HP projects. Such may be understood with an outset in grounded analysis by observing to what extend the conclusions in impact assessment reports (EIAs and IEEs) are being met in practice. Furthermore, gathering in-depth knowledge on the basis that current guidelines are being formulated will steer this investigation in the right direction. Thus, observing daily operations and workings of the HP plants on site as well as daily life in surrounding villages will amount to a crucial part of conducting such an investigation, or in other words, granting us a socio-technical perspective of the relationship between HP technology and humans. We believe that such a perspective will amount to more profound understandings of current issues, rather than trying to separate the technical and the social, thereby omitting essential mechanisms and dynamics that are part of such a reciprocal relationship.

The multiple answers or recommendations given to this research question is to be understood as a *discursive intervention* (Zuiderent-Jerak, 2015, p. 30). This is a popular approach in STS studies which, however, has met some criticism for the lack of

experimentation. A *situated intervention* does, on the other hand, entail experimentation which is a way of "manipulat[ing] our world in order to learn its secret" (ibid., p. 22). Though, this criticism is somewhat justified, a foundation for such experimentation is far from realistic for this thesis, since it would require government approvals or at the very least the opportunity for us to reconfigure. Additionally, this would to some extent, direct an assessment process of an on-going HP project, which would require a substantial amount of time. Instead, we believe that a discursive intervention will be beneficial as long as actors in different areas of HP development recognise the benefits in these recommendations, on an individual level as well as in a broader perspective, for the benefit of Nepal. While this appears to be an idealistic goal, we strive toward an inclusive aim in order to eventually narrow down to a realistic one. By doing so, this investigation will explore many options and avenues that may be feasible for the context of Nepali HP development.

3. Project Design

HP is classified as a sustainable energy source. However, the term *sustainability* lacks a precise definition as it may refer to a wide array of areas depending on the context and the applied technology in question. In the case of HP, sustainability encompasses more than sustaining the natural environment. It also refers to the notion of *good practice* in regards to economic and socio-cultural considerations that is affiliated with all phases of HP construction (International Hydropower Association, 2010, pp. 5-12; Kumar and Katoch, 2014, pp. 104-107). These three categories of considerations open up for a vast field of indicators, each of which provide *"*(...) a clue to a matter of larger significance or makes perceptible a trend or phenomenon that is not immediately detectable*."* (Kumar and Katoch, 2014, p. 104). Depending on the contextual implications related to the geographical site chosen for HP development, a number of these indicators may be of relevance.

The issues mentioned so far are based on second hand knowledge gathered from primarily academic literature. To further explore these and perhaps discover previously unknown issues, we spent two months gathering data in Nepal. In terms of empirical data, we have obtained first-hand knowledge from our case studies by conducting qualitative ethnographic fieldwork. Moreover, we have conducted an additional four interviews in Kathmandu with actors that are engaged in the HP sector or familiar with it in different ways. Lastly, we have used digital tools to gather online data, which will be used in visualisations. Firstly, the online landscape of HP actors as it appears through hyperlink connections in a network of websites and, secondly, the academic interest in HP development over time along with an explanation of its current state. The empirical data of the online world, thus, present a wider perspective on HP, which serves to sustain and expand on the empirical data gathered in Nepal. Methodological, we have made use of classical anthropological virtues such as participant observation combined with ethnographic interviews in the natural environments of our informants. Regardless of such data originating from Kathmandu offices or rusty shacks in rural Nepal.

3.1 The Field of Hydropower

A vast field of actors play a role within multiple areas of HP development in Nepal. Despite that fact that we have described and argued for our area of interest, it would be pretentious to claim that this thesis has comprised all actors within this delimited area. To even speak of a delimited area is unrealistic, since the actors and networks that we have discovered through an ANT approach extend beyond what is touched upon throughout this thesis.

Therefore, this chapter modestly aims to unfold the part of the HP field which has made up our area of the investigation.

To begin with, it is important to introduce the geographical divisions and subdivisions of political power in Nepal in order to understand how political power is disseminated and thus the many levels of bureaucracy that influence HP development. The country is divided into five regions each of which contains a number of districts that amount to a total of 75 districts (Vandernoot and Van Hove, 2014, p. 353). AHPP, IHPP, and LIHPP are located in the central and western region, which by far are the most developed regions of Nepal. To put in perspective, the central region generates 79.49 percent of the government revenue and 59.26 percent of government expenditure is dedicated to this region, which has highly to do with the fact that Kathmandu is located here (Ibid.). This is an interesting fact considering that 86 percent of the total population lives in rural areas (Sovacool et al., 2011, p. 3469). Districts are further divided into municipalities and yet again into Village Development Committees (VDCs) and/or wards. In our case the villages around AHPP, IHPP and LIHPP, each had a VDC, which constitutes the second level of political administration that HP companies have to engage with in the process of carrying out HP projects (Np.undp.org, 2018). Depending on the size of the village it may be divided into wards, which constitutes the most locally positioned level of political administration. Bigger cities like Pokhara and Kathmandu consists of wards only.

To illuminate the landscape of HP development in the light of environmental impacts, we have, as already mentioned, spoken to informants in Kathmandu as well as on-site at AHPP, IHPP, and LIHPP. This landscape is dynamic in the sense that it is affected by the formation and deformation of different actors and networks based on interests (the concepts of network building will be unfolded in chapter 5.1). The point is that Nepal has a formalised legal framework, in terms of acts, regulations, and guidelines, that set the boundaries that HP developers have to navigate within. The challenge is, however, to implement this framework in practice within the different levels of governance. In order to acquire an overview of the different roles that informants, organisations, and legislation play, we strongly recommend the reader to consult Appendix A throughout the thesis, since it functions as an encyclopaedia of aforementioned and thus will assist the reader in fully comprehending the challenges connected to sustainable HP development. As previously implied, different interests may hinder such development which in turn will be at the expense of the environment.

3.2 Timeline of Hydropower Development in Nepal

Prior to framing the case studies of this research, a timeline will explain the historical events that have formed the HP sector. The timeline (figure 1) displays a histogram of HP in Nepal relevant to this research. Firstly, Pharping HP plant was operational in 1911 as one of the first HP projects in Asia. Thereafter, it is important to note the creation of *Nepal Electricity Authority* (NEA) in 1985, which would become the sole distributor of electricity in Nepal (Sharma and Awal, 2013, pp. 685-686). When democracy came to Nepal in 1990, investment policies in the HP sector was changed, which allowed private HP developers to enter the market, however most HP development was halted for almost a decade (Ibid.).

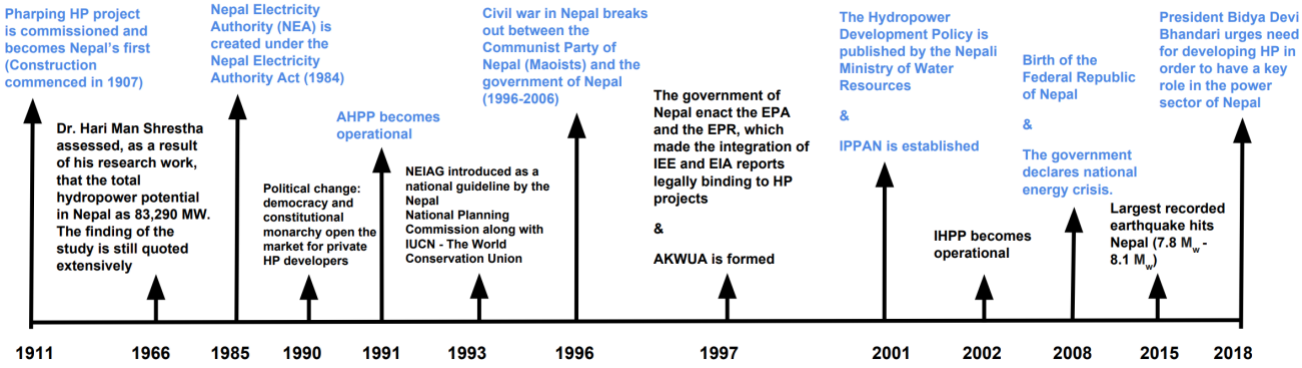


Figure 1: histogram of important influential events in HP development in relation to the case studies.

The civil war of Nepal (1996-2006) brought forth ideas that challenged Nepali social structures, i.e. the caste system, and thereby gave renewed hope of social mobility to those in the lower layers of society (Lawoti, 2009, pp. 7-11). Notions of social equality had already reached Nepal, with the creation of the *Andhi Kola multi-purpose Water Users Association* (AKWUA) in 1997. This association was formulated as a response to unequal benefits of HP and sought to ensure equal allocation of water rights amongst land owners, tenants in addition to landless people at AHPP (van Etten, van Koppen & Pun, 2002, p. 7). In this period in the 1990ies different guidelines, acts, and regulations were put in place to secure sustainable HP development, and in 2001 the Hydropower Development Policy (HDP) was formulated to increase private investments in HP by highlighting the many positive prospects in HP development. The same year, the private sector tried to revitalise itself by establishing the *Independent Power Producers Association, Nepal* (IPPAN) which is an interest organisation which, among other things, have secured *power purchase agreements* with the NEA (Ippan.org.np., 2018; Munch-Petersen, 2017, p. 7). The support of communism grew at the turn of the millennium resulting in communist parliament majority at the 2008 election and consequently this became the fall of the Nepali monarchy and rise of the republic (Lawoti,

2009, pp. 5-6). 2008 was also the year when the government of Nepal declared Nepal to have a nationwide energy crisis, which saw large parts of the country experiencing blackouts for up to 12 hours per day (Munch-Petersen, 2017, p. 7). In 2015, an earthquake hit South Asia with devastating consequences. Nepal's infrastructure was severely damaged and many HP plants shut down, causing widespread electricity blackouts. Nepal slowly recovers and in January 2018, the President of Nepal, Bidya Devi Bhandari, publically advocates for further investment in HP sector in order to, firstly, meet the growing demand of constant electricity in Nepal, and, secondly, to place it in a commanding position in the power sector of Nepal (The Himalayan Times, 2018).

4. Case studies

This thesis will draw on first hand ethnographic knowledge, which has become accessible through the cooperation of two hydropower companies, NHPC and BPC. We have visited two sites where each company has an operational HP plant. Each of these sites along with the respective HP company constitute a case that are chosen based on specific similarities, which makes them relevant for the scope of this study. Individually, they bring forth different perspectives on social issues in connection to hydropower. The similarities and differences will be touched upon in the next section. In framing each site as a case study we draw on understandings belonging to Helen Simons (2009) and Bent Flyvbjerg (2006). Adopting this framing enables us to gain knowledge on the contextual particularities of each case rather than trying to measure and quantify data (Simons, 2009, p. 20). Furthermore, it allows for generalisations based on individual cases as in depth understandings of a few cases often result in a better learning process than assuming a critical distance that result in a lack of feedback from the field that is being studied (Flyvbjerg, 2009, p. 223). The two cases have been chosen based on an expectation that the issues they contain and the exploration thereof will be of relevance for answering the research question. This is also known as a collective case study as they in combination serve the same objective (Simons, 2009, pp. 21-22).

There are two essential similarities between the two cases, which are the technical features of the HP plants and the legislative requirements for impact reports (environmental, economic, and social prerequisites). Amongst the interesting differences between the two HP companies is the fact that BPC is a much bigger company than NHPC measured on revenue (Butwal Power Company Limited, 2017, p. 8; National Hydro Power Company Limited, 2017, p. 31) as well as by the number of subsidiary companies dealing with different aspects of HP development and other infrastructure projects that BPC possesses (Bpc.com.np, 2018a), which affect how they conduct HP projects. Furthermore, BPC has been engaged in the hydropower sector since 1966 whereas NHPC dates back to 1995. Today BPC is the proprietor of five operational HP plants and several new HP projects are in the pipeline. By comparison, NHPC currently has one operational HP plant and two HP projects in the pipeline. Map 1 marks the location of the three HP projects, which we visited.

Map 1: the two location of the three HP projects.

4.1 The Case of National Hydro Power Company

NHPC was founded in 1995 as a joint venture formed around Nepali owners and the former Norwegian company, Lyse Kraft AS. Today, NHPC is a listed public company and stocks are traded at the Nepal Stock Exchange (Nhpcl.com, 2018). As is the case with most other companies in Nepal, the headquarter is in Kathmandu, which was a logistical advantage as Kathmandu made up our 'base of operations'. NHPC was the first of the two cases, which allowed for an entrance to the HP field of Nepal. By taking this route, we would acquire a view on HP from a company perspective. The obvious upside was the direct access to the company's HP projects, which would have been more difficult in any other way. However, as the entrance was thus facilitated by a strong HP proponent, we made sure to engage other stakeholders with other views on subjects such as policy-making processes and enforcement.

NHPC's chairman of the board, Kumar Pandey, expressed great interest in our project and the opportunity for NHPC to learn from it which reflects the company's acclaimed vision of "(...) ensuring technical viability, financial sustainability, and environmental and social equality." (Nhpcl.com, 2018). NHPC's interest in our project was furthermore materialised in that they granted us access to their IEE and EIA reports, which we interpreted as a matter of trust, as these types of reports are not prone to public disclosure. Besides being chairman of the board in NHPC, Pandey is also the vice president of IPPAN. This make Pandey further interesting as the focus of IPPAN is to "(...) act as a link between the

private sector and government organizations involved in developing hydropower in the country (...)" (Ippan.org.np, 2018). Thus, more than being the head of a private HP company, he is also a political player through his advocacy of HP development.

NHPC is operating an HP plant (IHPP) near the small town of Melamchi, less than 60 km northeast of Kathmandu, which made it fairly simple to plan and carry out site visits. IHHP became operational in 2002. Five km further downstream from IHPP is the planned location of LIHPP, which is owned by Sunkosi Hydro Power Company Limited which is a subsidiary of NHPC. Some construction work had already been carried out, but due to the fact that project deadlines have been exceeded, licences have been revoked, hence, construction work is currently at a standstill. NHPC is currently in the process of re-obtaining licences in order to continue construction (Nhpcl.com, 2018). The circumstances and polemics that surrounds having an operational HP plant side by side a currently halted project, allow us to extract different concerns belonging to local villagers and staff at IHPP. Additionally, these actors are engaged on different levels in two separate phases of the HP projects, hence, adding to the amount of issues that are present.

4.2 The Case of Butwal Power Company

In 1954, the Norwegian Tibet Mission made its entrance into Nepal after having been denied access to Tibet. At this time, it joined forces with other Christian missions and primarily with the Americans becoming a union later known as the United Mission to Nepal (Simensen, 2006, pp. 90-91). Since any evangelisation principally was forbidden in Nepal at the time, the United Mission to Nepal concentrated on practical work (ibid.). The electrical engineer and missionary, Odd Hoftun, established the Butwal Technical Institute, which provided technical educations for Nepalis and in turn human resources for the creation of BPC in 1966. Hoftun established BPC as a non-profit company with an ethos based on "(...) truthfulness (not hiding one's errors), punctuality, precision and discipline", (Barroso, 2015, p. 390) all of which Hoftun considered protestant virtues (ibid.). In 1993 the Nepali government took over all BPCs assets and in 2003 BPC was privatised after a competitive bidding (Bpc.com.np, 2018b).

In 1991, the construction of AHPP was completed and operational. It was built using old refurbished electrical equipment from Norway. In 2009 the BPC subsidiary, Hydro-Consult Engineering Limited (HCE), was conceived with the purpose of providing "(...) consultancy and other engineering services." (Bpc.com.np, 2018a). HCE has among other things been responsible for conducting the IEE report prior to the 2015 upgrade of AHPP. This project distinguishes itself by also providing irrigation water to nearby farm land and by having established AKWUA, which is an association consisting of 14 members elected from

the local villages of which one is the general manager. The main purpose of AKWUA is to oversee the equal distribution of irrigation water (van Etten, van Koppen & Pun, 2002, p. 7). AHPP is an exemplary of how to develop and implement HP in a way where the concerned public is granted some autonomy in the form of AKWUA. Most likely this is why AHPP has been awarded the prestigious Blue Planet Prize by the International Hydropower Association's (IHA) for "(...) demonstrat[ing] excellence in sustainable development." (International Hydropower Association, 2016). AKWUA is the main aspect contributing to the uniqueness of AHPP, where "(...) water is diverted to another valley and a part of the irrigation water is thus supplied and the rest is used for generation." (Pradhan, P. M. S. 2018, BPC interview, 26 April). This is achieved due to an agreement between AKWUA and BPC in 1987 that ensures shared diverted water for local usage. However, in case of low water levels, then electricity generation would be given priority over irrigation water (van Etten, van Koppen & Pun, 2002, p. 8).

The two case studies described in the above are, technically speaking, comparable, however, they do differ in terms of organisational structure and obviously also in geographical location. In turn this influences the contextual socio-technical dynamics that take place, which make the cases complement one another well, thereby adding to a more comprehensive understanding of the challenges in Nepali HP development.

5. Theoretical Framework

The potential of HP in Nepal has been well-known since the 1960s (Sharma and Awal, 2013, p. 685) and with the publication of the 2001 HDP, by the former Ministry of Water Resources, the interest of the Nepali government in HP development became clear to the public. This policy can be understood as an all-encompassing development plan for Nepal financially as well as socially and in doing so aims to support the well-being of Nepali citizens by keeping "(...) an entire generation from growing up in the dark." (Lord, 2014, p. 112). This interesting analogy by Lord (2014) holds a literal understanding, as well as a complex figurative interpretation. The latter was unfolded by a local villager living in the area of the IHPP. This informant asserted that HP brought accessibility to knowledge and information through smart devices and TV that was previously unavailable. Mandatory HP reports, such as EIAs and IEEs, aim to respectively assess and predict such impacts in order to include the multiple concerns and provide a fertile foundation for development and continuous operationalisation of HP. Nevertheless, this is not always the reality. The aforementioned notion of access to knowledge through HP might the voice of the majority of the concerned public or perhaps just one of a lucky few, who reaped the benefits from HP, in whichever case it remains that a positive experience, or negative, situates itself according to the concerns of the actor. Such an understanding is based on notable ANT contributor, Bruno Latour's, idea of MoC wherein actors position themselves according to their concerns in a controversy (Latour, 2004). These concerns often materialise into *matters of fact* (MoF), that should be understood as "(...) a poor proxy of experience and of experimentation and (...) a confusing bundle of polemics, of epistemology, of modernist politics that can in no way claim to represent what is requested by a realist attitude." (Ibid., p. 245). Thus, by adopting this understanding, we acknowledge that there often exists an absence of a mutually agreed-upon base of knowledge that could sustain a claim, which falsely assumes the role of a representative of concerns belonging to all actors in a network (Latour, 2005a, p. 162). Instead, it calls the concerns into question belonging to the multiple actors of a network that may expose certain contradictions to the claim. In other words, it is impossible to separate facts from values (Blok and Jensen, 2011, p. 78) and they are rarely shared by all actors in a network, although it may appear so from an external point of view.

Within the arena of HP in Nepal, a similar understanding is needed in order to expose the existence of the multiple issues and concerns associated with HP development which sometimes are omitted in EIA and IEE reports. Moreover, the subject of HP itself holds many meanings at which point differing and often contradicting values and consequences are situated across a dynamic field of actors. Therefore, it is pivotal not to perceive actors as entities with an array of neatly corroborating concerns, rather a single actor may possess

several concerns of contradicting nature (Latour, 2005a, p. 116); a farmer living close to a HP project may for instance express his or her doubts on job availability in connection to HP and at the same time acknowledge the benefits of new roads (which is a necessity for HP development) as it facilitates the possibility of outside employment.

This thesis will draw on ANT as it provides a rich theoretical framework for illuminating the multiple actors that have a stake in HP development and the adequate tools for mapping out a network of actors and issues. As already touched upon, this entails and investigation of how different claims and facts are established which in this context particularly relates to the preparation of EIA and IEE reports. Investigating into the scientific arguments that support a specific claim or fact in these reports are, however, not a sufficient objective in itself. Although such a deconstruction may successfully open up the black boxes of HP, it does not provide a solid base for exploring opportunities for change which could potentially augment current assessment procedures. Instead, we may benefit from the admission that facts are not necessarily a product of our experience, of reality and, hence, reality is not defined by MoFs (Latour, 2004, p. 232). Such an admission entails a move away from MoFs and toward the realisation that reality consist of a multitude of *matters of concerns* (MoC).

> "A matter of concern is what happens to a matter of fact when you add to it its whole scenography, much like you would do by shifting your attention from the stage to the whole machinery of a theatre. This is, for instance, what has happened to science when seized by the recent "science studies" (...). Instead of simply being there, matters of fact begin to look different, to render a different sound, they start to move in all directions, they overflow their boundaries, they include a complete set of new actors, they reveal the fragile envelopes in which they are housed." (Latour, 2005b, p. 39)

This definition entails that in order to approximate a full comprehension of an MoC, one must locate and understand the different viewpoints surrounding that particular MoC. Only then will the MoF lose strength and what before was a monochrome interpretation of reality is now turning into ambiguous representations of reality as seen through the eyes of its actors.

This realisation will constitute the basis for exploring different opportunities as any constraints, which dictate a dichotomous reality where the notion of mutually agreed-upon facts have been dissolved. Within the field of science and technology studies, ANT follows the tradition of not making any a priori distinction between the natural world and the social world (Blok and Jensen, 2011, p. 141). Thus, an essential part of our theoretical tools is distinguishing between what is MoCs and that which is MoFs. By adopting such an understanding of networks, this research shall avoid making any a priori assumptions.

5.1 Actors, Networks, and Translation

In the previous subchapter, this research committed itself to an ANT understanding that includes MoFs and MoCs as these notions constitute a strong framework for a detailed and versatile investigation of the networks that are formed around HP. Such 'versatility' should be understood in the sense that ANT, especially as a consequence to the works of Latour, adds an anthropological dimension to the theory and thereby releases it from the constraints of a specific epistemological understanding, which may turn it into an empirical philosophy (Blok and Jensen, 2011, pp. 4-5). Such empirical philosophy springs from thick descriptions acquired from the case studies, i.e. taking into account the context in which agency unfold. It is, in other words, more about *logistics* than *logics*, i.e. to trail how knowledge manifests itself when it e.g. it travels from villages near HP sites into corporate offices in Kathmandu (ibid., pp. 26-27). We shall apply ANT by unfolding the mediation that takes place in between actors in a network; known as a *translation process* (Callon, 1986). In order to understand this process a few things should be said about actors and networks. An actor is defined by its relations, which in turn grant it its ability to act. This entails a semiotic understanding in which the actor may appear as both a human and non-human entity. This entity may be a single person or a whole organisation consisting of multiple persons, animals, and things (Elgaard Jensen, 2003, pp. 6-8; Law, 1992, pp. 381-384). If an actor can be an organisation consisting of fundamentally different entities, then what is the difference between an actor and a network? In principle there is no difference since agency only exists because of heterogeneous networks, i.e. different types of relations within a network. The network is, however, dynamic whereas the actor has attained stability, thus, making its actions predictable (ibid.).

By having clarified the relationship between actors and networks, we may return to the translation of a network. Translation is the process of organising a network through negotiation of identities among actors. Understanding this process means understanding the agency of an actor, which otherwise remains undisclosed or *black boxed*. Without disclosure this black box is characterised by having an input and an output, while the reasoning for its agency will remain concealed inside the box (Latour, 1987, pp. 1-5; Elgaard Jensen, 2003, pp. 8-9). The translation process consists of *four moments of translation* during which the identity of actors, the possibility of interaction and the margins of manoeuvre are negotiated and delimited." (Callon, 1986, p. 6). By assigning to this framework, this thesis commits to the task of investigating the moments of translations that the actors in the HP network have undergone. An important stage of these translations, and also the first moment, is *problematisation*, which refers to the instance when actors define their problems and in turn

also their position in respect to other actors as well as the network itself (Ibid., pp. 6-8). Another important term in the translation process is the *obligatory passage point* (*OPP*). This is the place where alliances in the network are forged through common interests and problems, which results in all those who pass the OPP become indispensable. In the case of HP, the common interest is electricity and the common problem is associated to the obstacles of acquiring electricity. For an OPP to be revealed, the negotiations surrounding *interessement* (the second moment) have to be successful in the sense that all actors recognise a personal benefit and thus become *enrolled* (the third moment) in the project (Ibid., pp. 7-12). The OPP is thus the critical passage for materialising HP projects, and more importantly it is a passage for us as researchers, to investigate the strategies and negotiations that takes place in order to *mobilise* (the fourth moment) actors in a single unit. Hence, actors become mobile and are displaced by a progressive *spokesperson* who by now has adequately strong alliances in the network to render the acclaimed spokesperson capable of speaking on behalf of the entire network, thereby *aligning* the various interests of the multiple actors into an overarching objective (ibid., pp. 12-15). By doing so the spokesperson "(...) silence those in whose name [s/he] speak[s]" (Ibid. p. 14), which Callon points out is a strenuous task as human beings have a tendency to revolt, but to speak on behalf of the suppressed and voiceless is even harder (ibid.). This is to say that networks, though stable, are dynamic in nature and require continuous reconfiguration for them to remain stable. In terms of IHPP, LIHPP, and AHPP there may be up to several spokespersons, thereby, revealing a power structure where they are on top. This may be true for most cases, but it is important to keep in mind that the spokesperson also has the capability to hide power relations between actors by displacing the individual actors' goals and interests (Ibid.). An overly centralised focus on the role of the spokesperson to open up black boxed knowledge is thus associated with an inherent risk of neglecting some actors. In order to avoid such a pitfall, we need other ways of exploring and comprehending networks.

5.2 Assembling a Tool for Exploring Matters of Concerns

Each actor of the HP network of Nepal holds their own stance on the matter of HP and within that role we identify knowledge or perhaps even an expertise. Such an admission should be understood, as a base of knowledge and offset, to be true for the individual actor and hold as much credibility and value as any other information held by other actors. This is the basis of an MoC which will assist an understanding of an actor-network with gatekeepers and power positions as ANT is often discussed as theory well-suited for drawing up a network, wherein actors may be revealed. Elgaard Jensen states that "ANT is a theory about theories (...)"

(Elgaard Jensen, 2003, p. 4), which includes social actors, society, nature and power. Thus, by appending the notion of MoCs to the HP networks a fruitful foundation is established, but in doing so a deeper epistemological understanding of actors and networks become necessary.

Callon and Latour discuss power and powerful actors in ANT by attempting to reveal micro and macro-actors. In this pursuit, they firstly reveal that any social differences that separate actors, i.e. level, size or scale, should not be understood as inherent to actors, "(...) but are instead the result of battles of negotiations." (Blok & Elgaard Jensen, 2011, p. 121). Blok and Elgaard Jensen (2011) continues this investigation by posing the question as to how micro-actors transform into macro-actors? Or, in Callon and Latour's terminology, how does an actor become a spokesperson? (Ibid.). This is related to the idea of *black-boxing* (of knowledge), which is often credited to the work of Latour. At the point when knowledge becomes black boxed, then it assumes a privileged and powerful position. However, the translation process that took place prior to arriving at this position also reveals the powerful (macro) actors (Latour, 2003, p. 242). The knowledgeable and powerful macro-actors in a network, who speak on behalf of others, are not guaranteed such a privileged position. Elgaard Jensen (2003) states that the powerful can be dethroned by other previously less influential actors. (Elgaard Jensen, 2003, p. 21). Thus, ANT can be said to most often have the perspective of the powerful. Yet, this is challenged by Elgaard Jensen (2003), who believes that rather than ANT taking the leaders' perspective it will assume leadership as an effect of a configuration of relations in a comprehensive network of actors (Elgaard Jensen, 2003, p. 24). Callon's story (1986) of the three biologists who speak on behalf of the scallops and the fishermen of St. Brieuc is a portrayal of how certain actors, in this case the biologists, become knowledgeable and powerful only because the other actors allow them to lend their power (Elgaard Jensen, 2003, p. 22). Interactions between actors, regardless of apparent power status, should all be seen as "(...) equally microscopic in structure, though they obviously involve significantly different distances in space." (Knorr-Cetina & Cicourel, 2015, p. 39). This holds that the consequences of these interactions are shaped and perhaps radically changed through local practices. Thus it is important to distinguish between *voice* and *visibility*, when studying the interplay amongst actors in order to identify the powerful and powerless (Ibid., p. 40). Visibility is 'given' to those who speak (by using their voice) for others and they constantly have to stabilise and reaffirm their position as macro-actors in the network. As described earlier, one way to reach the top is to have the support of the other actors to ensure a powerful position and thus be able to share and formulate knowledge; black-boxing knowledge which in turn may transform claims into MoFs. Nevertheless, the idea of voice and visibility can be seen a highly relevant critique of ANT wherein certain

actors in a network have been displaced. These two notions are useful to reveal those who are powerless, which is not a given to be announced when locating spokespersons (as mentioned earlier). Yet, combining the idea of spokespersons, voice and visibility, this investigation is well-equipped to provide a valuable framework to give indications of power structures.

This investigation will draw out an HP network consisting of actors such as HP developers, policy-makers, the concerned public, and NGOs. They constitute some of the actors that assume an infrastructure where agency will unfold according to its particular interest in an MoC. In order to do so, we will adopt the ANT principle of following the actor and thereby identifying other actors of the network (Venturini, 2010a, p. 266). One such example is displayed in how our contact with BPC lead us to HCE which has turned out to be a valuable acquaintance in order to comprehend some of the issues embedded in impact assessments. We proceeded to follow one of these issues and let this issue unfold itself while we remained *critical proximate*. This is opted for rather than being critical distant as Latour claims that distance favours an uncritical protocol, which lacks a complete understanding or, in his words, neglects critical proximity (Birkbak, Petersen and Elgaard Jensen, 2015, p. 267). Such a method is useful as it denies the critical approach that aligns itself with frameworks favouring involved actors of the matter at hand, i.e. privileged actors (Ibid., p. 269). By associating with this 'Latourian' method, we will unmask the role that a given actor has in a network. By literally being present and in close proximity will reveal the mechanisms that elevates or perhaps demotes that actor's position. Avoiding distance, thus, allows the issues to unfold their sociotechnical formation in context (Birkbak, Petersen and Elgaard Jensen, 2015, p. 270). Due to the fact that such perspective pays particular attention to the relationships amongst actors, this investigation highlights the mobilisation of allies (i.e. Callon's fourth moment of translation). Hence, this research will put particular emphasis on the motivations or concerns that drive them to mobilise as they do.

In order to discover MoCs in the HP network of Nepal, we will adopt an alternative understanding of objectivity different from the traditional understanding which claims that an all-encompassing truth at some point in time will be revealed (Venturini, n.d., p. 1). Our preliminary expectation before entering or even exploring the HP-sector of Nepal was that we would be faced with debates and controversies. In anticipation of this, we align ourselves with the idea of *second-degree objectivity*. In Contrast, first-degree objectivity "(...) which is produced by reducing all perspectives to a single viewpoint is not suitable, or even possible in face of a controversy" (Ibid. n.d. p. 2). Thereby, accepting the idea that a *first-degree*

objectivity is not present, i.e. when all involved actors are in agreement within a MoF (ibid., n.d., p. 1).

Rather than this investigation being impartial, which would imply (too great of) a distance from the social phenomena at hand, it serves to explore a multitude of different viewpoints (ibid., p. 2). The notions, second-degree objectivity and critical proximity, revolve heavily around an acquisition of a sound contextual understanding when faced with a social subject matter. Second-degree objectivity urges this investigation to remain close to the issue at hand without neglecting the scale of it. Thus, avoiding to attend to concerns held by individual actors while neglecting all actors involved in the HP network. Meanwhile, critical proximity serves as a method for this research to build onto our approach by exploiting our close analytical proximity. This enables us to make thick descriptions of the underlying factors which are responsible for disparities between the MoCs uncovered by using second-degree objectivity. Such epistemologies amount to valuable perspectives when investigating into MoCs. To maintain an overview at the same time we may benefit from using digital tools that belongs to the arena of *controversy mapping*.

Controversy mapping is largely based on observing and analysing in the ways in which actors are "(...) engaged in tying and untying relations, arguing categories and identities, revealing the fabric of collective existence." (Venturini, 2010b, p. 796). Originally ANT was a tool to investigate sociotechnical debates, since then controversy mapping or cartography of controversies has served to display the social in its dynamic form (Venturini, 2010a, p. 261). On the basis of digitally harvested data from the internet and with the help of digital methods, we may establish aforementioned overview via digital maps which will be explored in detail in chapter 7.3.

Our theoretical framework consists of the distinction between MoFs and MoCs and more importantly as to why they have relevance to this research in addition to how both these ANT approaches amount to assets to the analysis of this investigation. Furthermore, we draw on an ANT understanding of network configuration, translations as well as the creation of black boxed MoFs. Finally, we have emphasised the necessity in remaining critical proximate and simultaneously committing to an inclusion of as many viewpoints as possible in the light of second-degree objectivity.

6. Hydropower Technologies

Classifying HP as sustainable is not unjust as will be underpinned in the technical description of HP technology in this chapter. However, as with most other great construction undertakings it does not come without a cost, as there is more to successful technologies than the apparent measure of greenhouse gas emissions. There are several technical aspects of HP development that may indirectly affect the livelihoods of the people living in the surrounding areas by affecting the natural environments that many rural people so heavily depend on. This chapter will address the dynamic relationship between the technical considerations of HP, which is either subject to the topographical and geological conditions of nature as well as the natural risks affiliated with climate change or it will have to try to control nature through a variety of technological initiatives.

In general hydropower plants can be categorised into four schemes: run-of-river (RoR) HP, storage HP, pumped HP, and offshore HP (Hydropower.org, 2018). The latter mentioned is based on a less established wave and tidal current technology, which is irrelevant to the context of Nepal as it is a landlocked country. The other three schemes of HP are relevant to Nepal, however, only the RoR scheme will be described in details as most HP plants in Nepal make use of this specific technology. There is, however, not a sharp delineation between the different schemes as e.g. a run-of-river plant may have some storage capacity (known as pondage) or a storage plant may make use of pumped storage technology (ibid.). Fundamental to all schemes of hydropower technology is the kinetic energy of flowing water from rivers. Flowing water is forced through the blades of a turbine, which makes the turbine rotate. The rotations of the turbine constitute the mechanical energy that drives a generator that in turn converts mechanical energy into an electrical current through electromagnetic induction (figure 2) (U.S. Department of the Interior, 2005). However, which type of HP scheme to opt for is to a large extent determined by the topographical features of the landscape.

6.1 Hydropower Schemes and Techniques

Much consideration is given before choosing the appropriate scheme of HP, such a decision is based on several factors. Technically speaking, HP companies have to take the natural surroundings into account along with two very essential parameters: the quantity of water available and available head (Majumder and Ghosh, 2013, pp. 15-19; International Renewable Energy Agency, 2012, pp. 5-8). Quantity of water refers to the available amount

of water flow in the river, whereas available head refers to the vertical fall of water (water pressure) from the headrace and until it enters the turbine at the tailrace (figure 2) (ibid.)

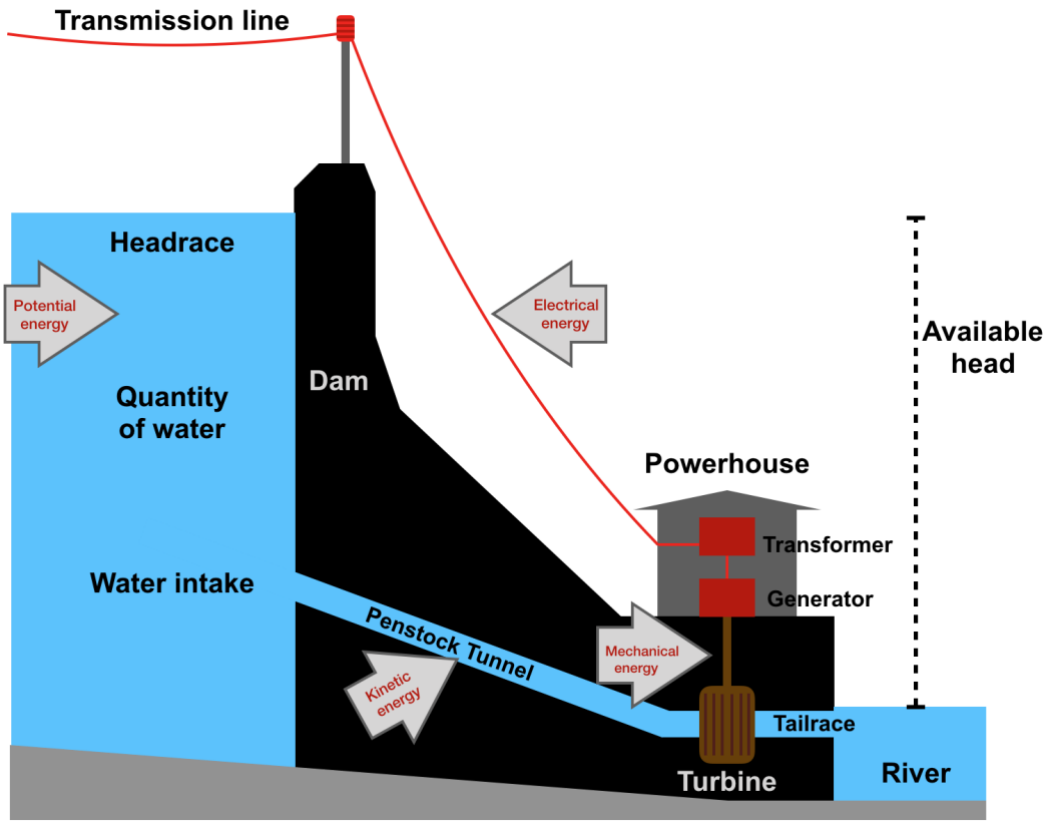


Figure 2: basic model of how kinetic energy is transformed into electrical energy (inspired by: International Renewable Energy Agency, 2012, p. 6)

Thus, available head and quantity of water are the two natural kinetic variables that influence the power capacity of a HP plant. The available head may be manipulated by e.g. increasing the distance between headrace and tailrace, which is the case of IHPP, where the powerhouse is positioned 3.5 km further downstream from the dam site (picture 2). Once construction of the HP plant is finished, head becomes more or less constant whereas the quantity of water is, as mentioned in the previous chapter, fluctuates throughout the year. In Nepal the river banks are high during the monsoon months due to increased rainfall and meltwater from the mountains (Sharma and Awal, 2013, pp. 689-690). This affect the choice of turbine (figure 3), which arguably is the most influential technical factor in HP production as it converts kinetic energy into electricity. Turbines are designed on the basis of quantity of water and head. There are two main turbine categories: *reactionary* and *impulse*. The design of reactionary turbines is primarily designed to utilise the momentum of water flow (quantity), whereas impulse turbines are designed to utilise the water pressure (head) (International Renewable Energy Agency, 2012, p. 7).

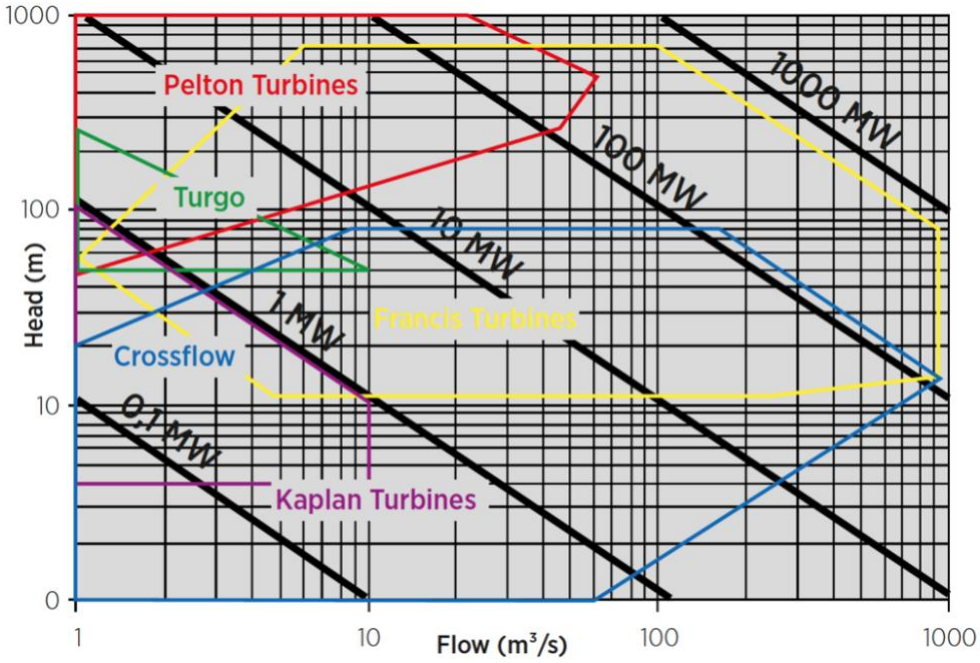
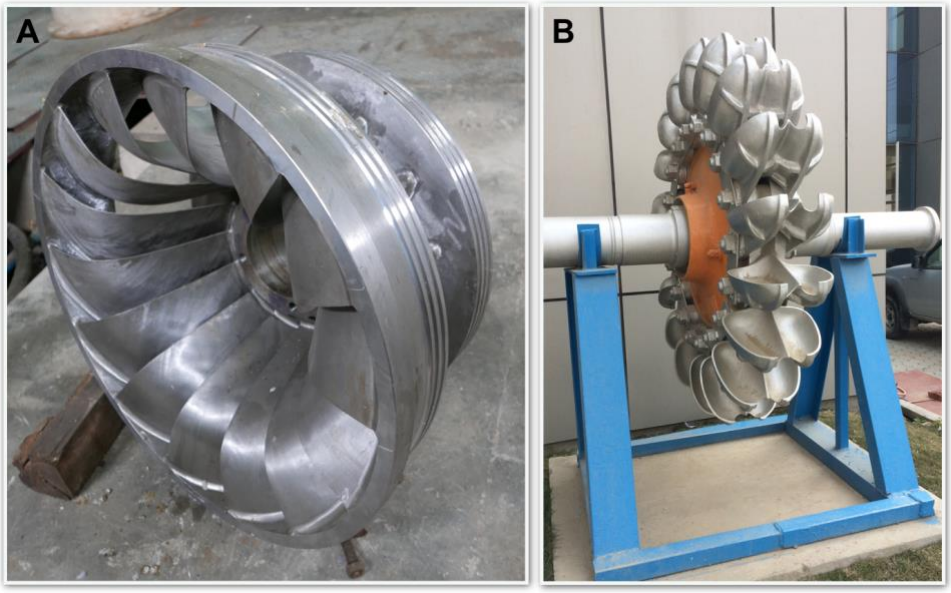


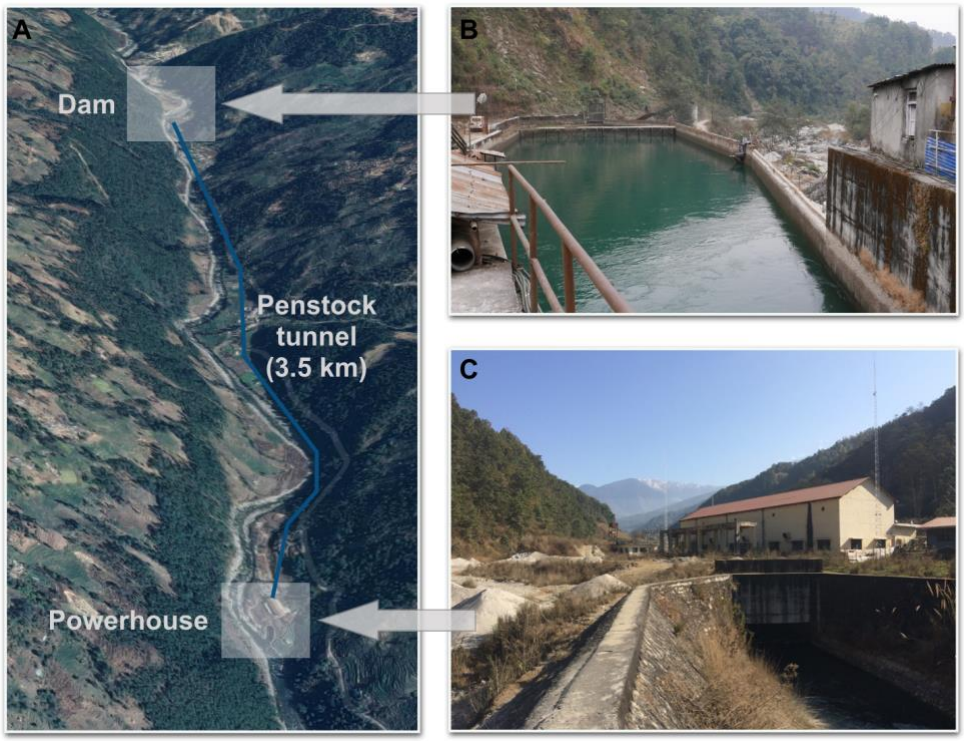
Figure 3: logarithmic scale of the optimal working areas for different types of turbines. The optimal working areas are defined on the basis of water flow (quantity) and head (water pressure) (International Renewable Energy Agency, 2012, p. 7).

The two HP plants that we visited make use of respectively the Pelton turbines (AHPP) (picture 1, A) and the Francis turbines (IHPP) (picture 1, B). This tells us that energy production at Andhikola, to a greater extent, relies on high head while IHPP, on the other hand, exploit both factors.



Picture 1: A) shows a new Francis turbine that is about to be installed at IHPP. Whereas Picture B shows a Pelton turbine similar to the ones at AHPP. It is displayed at the entrance to the BPC head quarter in Kathmandu.

As already indicated in the previous chapter both IHPP and AHPP are classified as RoR HP plants. Some topographical areas are more suitable for RoR scheme HP plants than others. In the case of both IHPP and AHPP, the rivers run in narrow valleys which do not allow for considerable storage capacity, partially resulting in the reason why NHPC and BPC has opted for a RoR scheme solution (picture 2).



Picture 2: shows a Google Maps 3D rendering (A) of a portion of the narrow valley in which the Indrawati river runs starting at the dam site (B) and ending 3.5 km further downstream at the powerhouse (C).

AHPP distinguishes itself from other HP projects in Nepal by being the only bi-purpose project in that it also functions as an irrigation hub and distributor for 599 hectares of farmland. Since AHPP is a RoR scheme HP plant it makes use of a penstock tunnel (1.3 km), but whereas IHPP has built it to acquire additional head the AHPP penstock only accumulate a water pressure corresponding to six vertical meters of water. In other words, it only serves the purpose of transporting river water from the dam site to the powerhouse. Instead, head is gained through a 242-meter vertical tunnel or drop shaft underneath the powerhouse before it enters the turbines and exits into the Kali Gandaki river more than 10 km further downstream (figure 4). However, not all water is directed toward the turbines as 0.3 m^3 of water pr. second is channelled through a pipe from the powerhouse to the surrounding fields for irrigation purposes.

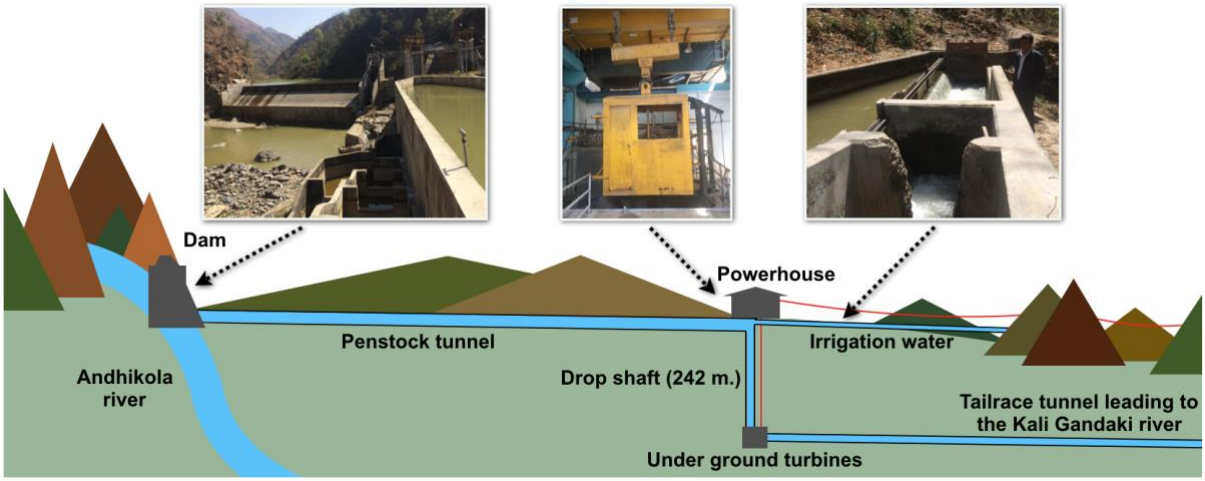


Figure 4: profile of the AHPP*. In order to increase head water is channelled down a 242-meter-deep drop shaft before entering three Pelton turbines. The turbines can only be accessed through a yellow elevator. A portion of the water, corresponding to approximately 600 kW loss in electricity production, is diverted around the drop shaft and is instead used for irrigation purposes.*

The main disadvantage of RoR HP schemes is to be found in the inconsistency in power production primarily due to the seasonal change in water quantity. Thus, IHPP and AHPP produce less power during dry season when the water level in the rivers are low, as opposed to the monsoon season when there is an abundance of water. The latter scenario results in a so-called spill which is when the kinetic energy of abundant water flow remains unexploited rather than being stored for use during dry season (ibid., pp. 8-13).

IHPP and AHPP are both classified as small-hydro which is defined by having a power capacity on the spectrum of 1 - 20 MW. IHPP has a calculated maximum capacity of 7.5 MW, however, at the time of visit (February, 2018) during dry season the running capacity was 3.6 - 4.0 MW. Until 2015 AHPP had a power capacity of merely 5.1 MW, which has now been upgraded to 9.4 MW by increasing the storage capability the dam site and by installing more effective Pelton turbines (Bpc.com.np, 2018a). LIHPP, when constructed, has a calculated maximum capacity of 4.5 MW (Nhpcl.com, 2018).

6.2 Technical Concerns

River bank erosions and in particular landslides are some of the frequent natural threads to HP production. They are induced by heavy rainfalls in the monsoon season and are very prevalent in the Himalayas due to the rugged and steep terrain of the mountains. Whenever these erosion and landslides occur there is a build-up of sediments in the rivers (Sharma and Awal, 2013, p. 690). HP plants have systems to deal with sedimentation, as sediments would otherwise damage the turbines. At IHPP a combined storage and sedimentation basin has

been constructed in order to filter the water before it enters the penstock tunnel and is lead down to the turbines in the powerhouse (figure 5).

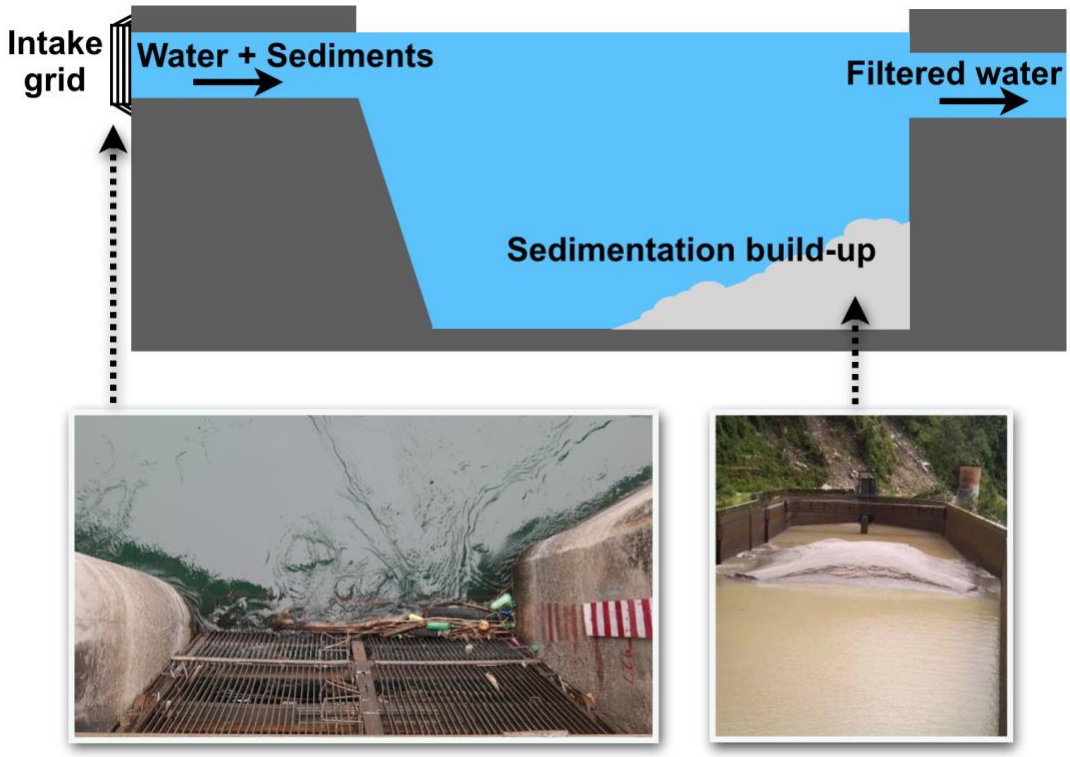
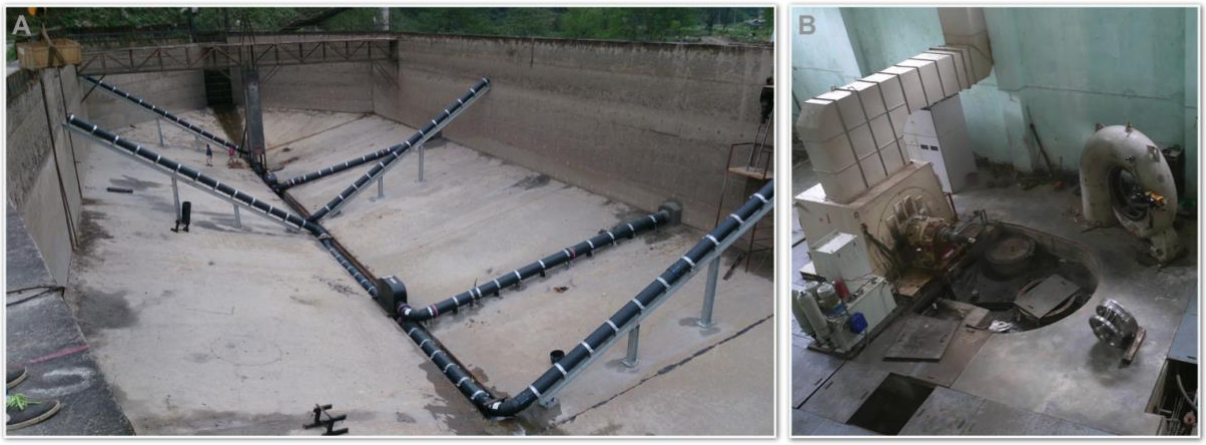


Figure 5: water is lead through an intake grid, which filters larger objects before it enters a basin where sedimentation from the water settles on the basin floor. The remaining filtered water is guided through the penstock tunnel and into the turbines at the powerhouse.

Until April 2017, when a new sedimentation removal system was installed, deposited sedimentation was removed during dry season, which entailed a full stop of power production for a period of time. After installation of the new system, sedimentation is continuously removed throughout the year without having to halt electricity production (picture 3). Filtered water does, however, still contain some sediments, which tears on the turbines. Thus, service or replacement of turbines occasionally become necessary and consequently, suspension of power production persists to be an issue, although the aforementioned system may prevent this in time.

Replacing, repairing or servicing technical parts of the plant is often possible while the HP plant is in operation.



Picture 3: installation of a new sediment removal system (Sedicon.no, 2018) at IHPP (A) and replacement of one of three turbines at the powerhouse of IHPP (B).

This was the case at IHPP at the time of visit, where on-site staff worked on the replacement of one of the three turbines as it had been worn down due to sedimentation and erosion. Landslides and the subsequent increase in sedimentation constitute in most cases a somewhat calculable risk that is handled by new technologies like the Sedicon Sluicer System (Sedicon.no, 2018). Ironically, HP plants possess the potential to cause landslides and river bank erosions during construction and further downstream when operational as a result of the controlled entrapment and discharge of water (Sovacool et al., 2011, p. 3472).

Another somewhat predictable concern revolves around the annual rainfall. During the monsoon season and post-monsoon months there is, as already stated, an abundance of water in the rivers which translates into a near 100 % electricity production of the estimated overall HP capacity of HP plants in Nepal (ibid., pp. 689-690). In dry season, the HP production decreases to roughly one third of that figure as the quantity of water in the river systems is proportionally low.

Picture 4: AHPP dam in March, 2018, during dry season. It is clear to see that most water is channelled into the two sedimentation basins (A) leaving the river bed almost dried out and as a result fish cannot enter the fish ladder (B).

The bulk of that water is diverted into penstock tunnels leaving "(...) at least ten percent of the minimum monthly average discharge of water in the river/stream or the minimum required quantum as identified in the environmental impact assessment study report." (The Hydropower Development Policy, 2001, pp. 8-9). Leaving the rivers nearly dry becomes a challenge for the migration of fish upstream as well as downstream (picture 4). At the two dam sites in the Indrawati and the Andhikola river this was clearly observable as we were given a tour around the sites.

7. Methods

Anthropology has historically distinguished itself as a discipline by its body of knowledge, i.e. using data that the anthropologist has gathered in exotic places by following virtues such as learning indigenous languages and perhaps most noteworthy to engage in *participant observation* (Descola, 2005, p. 65). Today, Anthropology still relies heavily on the methodological tradition of conducting onsite ethnographic fieldwork (Eriksen, 2004, p. 7). The point is that techno-anthropology draws, in part, on the same methodological toolbox and tries to honour the same virtues (Birkbak, Petersen and Elgaard Jensen, 2015, p. 267), however, some apparent issues are present. These will be introduced in the following section and unfolded in the chapters to come.

One of the aforementioned virtues revolve around learning languages. Since a fluency in Nepali was not going to be achieved then the use interpreters became a necessity, which is a neglected topic discussed in terms of the implications such has on a study. The fact that many researchers make use of interpreters is generally a downplayed subject (Borchgrevink, 2003, p. 98), perhaps because it could be considered a weakness and thus brings doubt about the reliability of the acquired data. As our ethnographic work primarily consisted of site visits and interviews, the use of interpreters was crucial for the investigation. It is important to point out that one of us, i.e. Losang, previously lived in Nepal, which meant having a decent level of Nepali language proficiency. This naturally benefited the process of conducting interviews, but more imperatively it helped secure part of the entries to the field through this researcher's local network in Nepal. By doing so, we embrace critical proximity as part of our ethnographic approach as we remain close and thus implicated in issues and formations of our subjects (Birkbak, Krogh Petersen & Elgaard Jensen, 2015, p. 266). Such allows us to record claims and concerns formulated and framed by our subjects. Thus, such a preliminary acquaintance with Nepal equipped us with knowledge on the workings of Nepali bureaucracy and the working culture.

The ethnographic methods used in the two case studies constitute our primary methodology, however, the use of digital methods have also been applied to map out the relationship between actors who are part of the online network of HP. Furthermore, digital methods are used to provide knowledge on the extent of academic interest in HP as an academic field. In regards to the field trips, these were carried out in periods of one to two days at a time, which brings us back to the virtue of participant observation. During these relatively short site visits, the amount of participation and the extent to which we could establish rapport with our informants and the surrounding communities were limited. There is, however, other methodological 'tricks' that we made use of in order to unfold various MoCs as well as to

approximate an understanding of the informants underlying reasonings and concerns. These tricks revolve around *practical knowledge*, which should be understood as a subject's tacit way of acting appropriate and/or effective (Zahle, 2012, pp. 50-51). Although, this way of 'decoding' cultural norms are by no means applicable to all situations it helped us acquire a more holistic understanding of the field.

7.1 Participant Observation and Decision Making in the Field

Participant observation is often categorised depending on the engagement that the researcher applies when in the field. At one end of the spectrum, one finds the *complete observer*, who tries to emulate the fly on the wall by not engaging with anything or anyone. At the other end of the spectrum one will find the *complete participant*, who will try to engage in all kinds of activities as well as develop relationships with informants over time (Takyi, 2015, pp. 864-869). None of these extremes are recommendable because of the obvious ethical dilemma of ignoring any type of *informed consent*, thereby 'spying' on the informants from a distance or by going undercover. Common to participant observation is the notion of studying informants in their natural environments, where the contextual setting reveals how informants react to different situations (Ibid.). In the endeavour of acquiring deep insights into a specific subject, the researcher will have to broaden his or her own perceptual skills by not taking anything for granted. Thereby, consciously using oneself as a sort of instrument. This entails a continuous shift between an inside (participating) and outside (observational) perspective in that the researcher acquires an inside experience and subsequently takes a step back to reflect on it from an outside position (Spradley, 1979, pp. 56-57).

The level of participant observation which we have adopted is in line with the Enock Takyi's broad definition of *participant-as-observer*, in which the researcher seeks to get involved with the informants in order to acquire an inside perspective (Takyi, 2015, pp. 868-869). As already problematised it would be incorrect to assert that we have reached a higher level of participant observation, however, some interesting situations did unfold based on aforementioned approach. One thing that which we learned was the definition of gender roles. In Nepal, the issue of gender inequality can be understood on different levels. On the corporate side of the HP industry, it is visible when looking at the board of directors in NHPC and BPC as well as the executive committee of IPPAN. Of the leading roles in the organisations only one was held by a woman. In rural Nepal, the gender roles differ as the majority of Nepalis here have their livelihoods centered around farming and handicraft products. We experienced such a contrast, when approaching women about their experiences with HP. In these situations, local men would often interfere and take over the

conversation, thereby, silencing the women that we had engaged in an interview. We sought to circumvent this issue by finding somewhat tucked away locations for the interviews or interviewing in two separate locations simultaneously. One of us would then interview a group of people (men), while the other would focus on interviewing women in the outskirts of the villages. Such ad hoc decisions were made in between interviews. This was also the time where we reflected on which type of questions gave the better answer and why certain questions, which we expected would provide interesting perspectives on HP development, were hard for informants to relate to, thus, hinting at a certain type of unawareness (a theme which will be unfolded in chapter 8.4).

Arguably, we unwillingly remained outsiders for most of our visits due to the short period of time spend at the two sites, but from that position we made use of other ways to gather inside understandings. In accordance with Julie Zahle's suggested methods to understand what is considered appropriate when it at the same time is tacit to the informants (Zahle, 2012, pp. 50-51), we found a way to benefit from the situations that took place in front of us during interviews. In general, we set out to conduct one-on-one interviews as they, due to the language barrier, were easier to control, but as already described this was nearly impossible. Although, we mainly considered this to be a disruptive element, we made the best of the situation by making "(...) observations of individuals' actions which are met with approval or disapproval by competent assessors." (Ibid., p. 56). This method reveals an implicit code of conduct through the practical knowledge that is acted out. At AHPP, a certain code of conduct became clear when suddenly the mood changed during a group interview when an informant expressed criticism toward HP construction in the area. He was met with disapproval by elder members of the village. In this example the elders of the village are the *competent assessors*, and as such the official voice of 'correct' ways and customs.

7.1.1 The Multi-Faceted Role of the Interpreter

Conducting fieldwork in places, where cultural norms and values are foreign to the researcher is arguably an advantage as there is less of a 'taken for granted attitude' as the researcher suddenly find himself in an unfamiliar environment. This may likely open up for interesting avenues to explore that might otherwise have been overlooked, but there is a reverse side to this, as the researcher will most often have to rely on the help of an interpreter (Borchgrevink, 2003, p. 108). The word 'interpreter' is often used synonymously with 'translator', but using the word, translator, is insufficient for several reasons: language is close connected to the particular social context in which it is used, thereby determining what needs to be stated explicitly and what may remain implicit to the conversation (ibid., p. 106).

Similarly, a particular lexical range that is used during a conversation may embody a specific worldview, hence, a way of structuring experience and action (ibid.). These are nuances of a conversation that requires a cultural understanding of the context in which they unfold in that it extends beyond mere translation. We worked with three different interpreters during our fieldwork. Two of the interpreters were born and raised in Nepal, whereas the third interpreter, though born and raised in Nepal, was an American citizen. Throughout the whole process of talking to Nepali speakers, the American interpreter became a part of the team for a variety of reasons. First of all, it was important for us to ensure that our interpreter understood the purpose of our project and the perspectives in the questions that we wanted to ask. Instead of stepping into the role as a somewhat instrumental language intermediary where one word in English is exchanged with its equivalent in Nepali and vice versa, we encouraged our interpreter to take initiative to pose related questions that he would deem beneficial for our investigation. We anticipated that the American-Nepali background of our primary interpreter would make it easier for us to ensure that he understood the outset and aim of our investigation, since culturally and socially speaking there would be less barriers and misunderstandings.

Including interpreters in research projects and to acknowledge the many roles they play in the research process (besides translating) is something which should be exploited, rather than being perceived as a weakness associated with the researcher's insufficient language skills and ethnolinguistic sensitivities (Berman and Tyyskä, 2011, pp. 186-187). We followed this notion by encouraging our primary interpreter to step into the role as a facilitator during interviews as well as a transcriber in between periods of fieldwork. The benefits of this, arguably less controlled approach, is a more in-depth and nuanced understanding of a specific issue (ibid.). The facilitating role became increasingly important in interview situations where we often found ourselves surrounded by (see picture 5) and interviews risked becoming somewhat chaotic and in turn run off track.

Picture 5: interview situation near IHPP.

Over time our primary interpreter became more comfortable controlling these situations and be firm when it was needed without distancing us as a group to our informants. This is perhaps the most valuable skill of the interpreter (besides the obvious) as a relaxed and informal atmosphere incites a base of trust and confidence (Borchgrevink, 2003, p. 109). Nonetheless, this atmosphere is not created solely on the social skills of the interpreter, but also by the influential caste system of Nepal, which similar to the Indian caste system is a social stratification of groups of people often based on their indigenous heritage. It is centered around the notion of status, which is an influential factor when conducting fieldwork. Low caste informants may be more reluctant to talk to interpreters of high caste, whereas high caste informants are very focused on demonstrating their own high status and thus conceal some undesirable truths (Borchgrevink, 2003, p. 103). Whether this is a general condition for social interaction in Nepal is hard to say, nonetheless, it was something we considered when choosing an interpreter. Our primary interpreter is of *Tamang* ethnicity which is one of the lower castes and the same as several of our informants at IHPP and LIHPP. It is doubtful as to how much of a difference it made in the data collecting process, however, we considered it a way of reducing the hindrance of which the issue of caste might constitute for the research.

Besides our primary interpreter, we made use of an additional interpreter in the transcribing process in order to ensure that specific passages of a more complex character would be transcribed correctly. When visiting IHPP and LIHPP the mechanical engineer at the site was eager to help us interpret during interviews. As he represented NHPC, he presented an advantage through a preliminary contact to the local community. At the same

time, we feared that his presence would steer our interviews away from critical remarks about IHPP and LIHPP. Fortunately, such scenarios did not take place.

7.2 Interviewing in Natural Settings

Polemically speaking no situation wherein, the researcher adopts any level of participation is ‘natural’, since once the informant is aware of the presence of the researcher that person is likely to alter behaviour (Takyi, 2015, p. 867). This is arguably a modification of the common understanding of the word, ‘natural’, as it mainly refers to the surrounding environment in which the informant lives out his or her life. Nevertheless, we should take Takyi’s perspective on the general lack of naturalness in research into account, when observing daily work as well as in interview situations.

All interviews were conducted in the natural settings of our informants in order to make them feel comfortable (Schuler and Namioka, 1993, p. 135). This includes AHPP, IHPP, the surrounding villages as well as offices belonging the various informants in Kathmandu. For all the interviews conducted, we made an effort of showing transparency by telling the interviewee about the objective of our thesis project and how we were planning to use the information given to us. In addition, anyone whose comments could possibly put them in a vulnerable position has been anonymised throughout the thesis. Most ethnographic interviews start with a sense of uncertainty and apprehension (Spradley, 1979, pp. 45-46), thus in order to reduce it, we started all interviews by posing some introductory questions such as: “Can you tell me about your educational background?” or “What kind of work do you do at AHPP?”. Starting off on such questions had the intention of relaxing the informants before getting into more broad questions related to HP development.

Common to the outset off all interviews was a semi-structured interview guide (Appendix B). It was rewritten continuously depending on the interviewee and as a result of new knowledge we acquired on the basis of previous interviews and observations. The interviews at the HP sites were for one conducted prior to interviewing Pandey and Pradhan in order to discover possible MoCs that could enhance the relevance of the questions that Pandey and Pradhan would be asked. The interview guides were favouring open questions such as “How do you regard current, as well as future, opportunities of hydropower in Nepal?”. This allowed for the participant to shape the discourse of the conversation, i.e. which topics to touch upon as well as how to talk about them (Schuler and Namioka, 1993, p. 134). Based on the loose framing, we discovered interesting subjects such as IPPAN’s role in HP development and the issues connected to the monitoring of HP projects (both of which will be touched upon in the analysis). However, this approach also has its downsides, as the

answers from time to time would digress into subjects of minor relevance, in which case we would try to steer the conversation back on track or ask open questions but directed at a particular subject, such as: “How do you envision that the process of conducting EIAs or IEEs may be improved?”. We recognise that this type of question may unintendedly contain a hidden judgemental undertone or even a passive aggressive way of pressing the interviewee to present answers of *meaning* based on a self-reflection of the operations taking place in the organisation or company that is being represented. This stands in opposition to one of the main principles when asking questions in the field, which is to ask for use, rather than meaning, thereby, acquiring descriptive answers of cultural meaning by “(...) understanding how people *use* their ordinary language.” (Spradley, 1979, p. 47). We acknowledge that interviewees may sometime appear perplexed by questions like the aforementioned one, although we experienced that better answers were given in some cases. This experience was confirmed when interviewing higher ranked employees of NHPC and BPC by being very direct in our communication. At times when we asked very descriptive questions such as: “How do you make use of water and electricity in your daily lives?” we would, on the other hand, confuse the interviewee since the question would sometimes be perceived as being rhetorical. Though this was not always the case, the point is that we had to understand the contextual environment and accordingly take that into account when formulating the interview guides.

7.3 Acquiring a Digital Overview

We have argued that contextual particularities as well as generalisations may be extracted from our case studies in the form of MoCs. We may further explore these MoCs by perceiving them in a duality of networks and actors. This should be understood as both an offline and online visualisation of the networks where the actors of this investigation are present. We are thus dealing with two sets of data: one inherent to the ‘offline world’ and the other inherent to the ‘online world’. Thus, a fair presentation entails an equal validity of the two ‘worlds’ as a specific MoC may appear to a bigger issue online than it does offline. This pitfall is important to avert since “(...) [m]inorities are sometimes over-represented in online debate and some groups exist almost exclusively in the cyberspace.” (Venturini, Jacomy and Pereira, n.d., p. 8). Such a scenario displays a discrepancy between offline and online agency. Recognising that we have to stay wary and critical, when using digital methods has to be a constant self-reminder due to the fact, that very little is constant and non-manipulative in the online world. Evidently, this could be said using any kind of method. however, our intention of building strong qualitative arguments on the basis of data, which

has been extracted through mathematical computations, presents a complexity that arguably demand us to navigate along a much finer line (Venturini, Munk, and Jacomy, n.d., p. 6). Digital visualisations may, nonetheless, provide a rich supplementary perspective in illuminating the ways in which offline actors position themselves in networks online. The online reality has undoubtedly become the primary platform for knowledge sharing, and subsequently the discussions it gives rise to. Yet, the online world does not represent everything that is digital and even if it did, it is not an identical resemblance of the world; e.g. face-to-face interactions are not taken into account (Venturini, 2010b, p. 803). It does, nevertheless, still constitute an interesting analytical point of departure, since arguably the gap between the digital and offline world is closing in (Rogers, 2012, p. 215).

A digital overview can be visualised in various ways and therefore MoCs can be presented accordingly. Our input data is divided into two types which is categorised according to the origin of the data. The first type is a composition of websites that covers an online HP landscape of hyperlinks, while the other seeks to explore the role of academia in HP development. Gephi is used to create visualisation after careful consideration as to the purpose of the data (which is further explained in the following chapters).

The essential elements of digital mapping are *nodes* and *edges*, which also amount to the foundation of the visualisation. Nodes can be understood as actors. Whereas edges should be seen as connections between those actors. Depending on the type of network these connection points may be defined as hyperlinks, keywords in publications, bibliographical references, etc. Nodes can and will vary in size, which, simply put, indicate how well-connected the node is. The size of the node may for instance be determined on the basis of *in-degree, out-degree*, and *occurrences count*. In-degree is the total amount of incoming connections to a node and out-degree is the opposite (Venturini, Jacomy &. Pereira, 2015, p. 13). Occurrences count may be chosen in reference networks and is a measure of the number of times two nodes co-occur in the same text, paragraph, document etc. (GitHub, 2018). A software programme, in our case, Gephi, is used to spatialise the nodes with a force-vector algorithm in a way where "(...) nodes are charged with a repulsive force that drives them apart, while edges work as springs bounding the nodes that they connect." (Venturini, Jacomy & Pereira, 2015, p. 2). The algorithm is iterated a number of time until nodes and edges reach a steady state (Venturini, Jacomy & Pereira, 2015, p. 3). Thus, ideally the network map transforms from being a 'hairballed' mess of nodes and edges to being a landscape with groups of nodes, such a phenomenon is called *clusters*. In case the map still appears hairballed after spatialisation a modularity algorithm can be applied which helps in detecting 'hidden clusters' in the network by measuring the density of edges and impose dissections in the form of colour segmentation between areas of high node

presence, hence, less edges (Venturini, Jacomy & Pereira, 2015, p. 4). In between clusters you may find scattered nodes; these are known as *bridges*. Bridges show that "(...) clusters are connected by hyperlinks[1] because they share analogous interests and worries and a similar language." (Venturini, Jacomy & Pereira, 2015, p. 8). This bridging positions constitute an important subject for digital mapping due to their gatekeeping roles. Analysing the bridging node between two clusters (or networks within a network) may shed light upon a common ally or interest shared across clusters. Digital maps may be monopartite or polypartite, which indicate whether a network has one (i.e. mono) or more (i.e. poly) types of nodes. A Facebook network may e.g. constitute a bipartite network when nodes are defined as either Facebook pages or Facebook users. All of the above techniques amount to a toolset that allows us to create different types of HP landscapes which will bring forth new perspectives as well as actors.

7.3.1 Mapping the Landscape of Hydropower

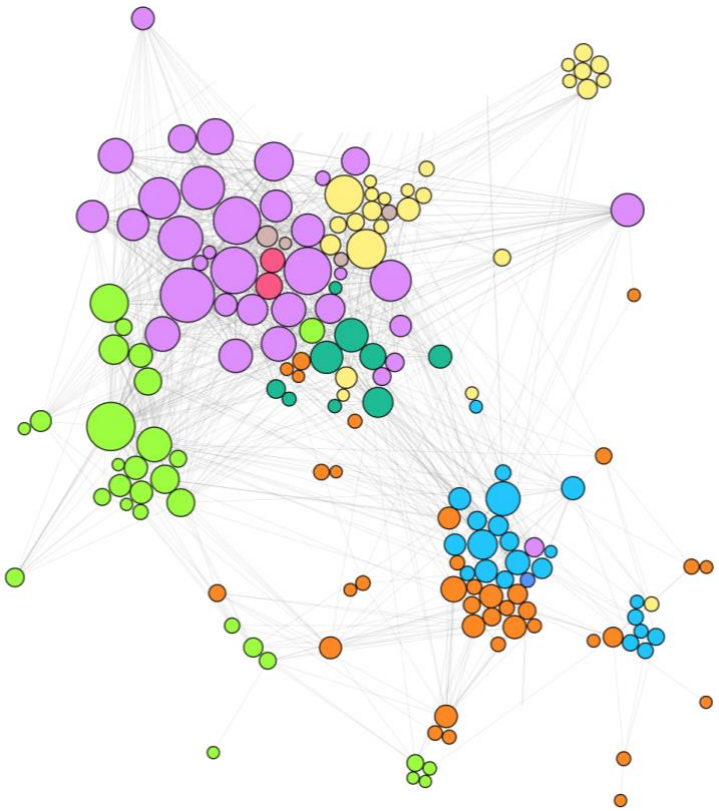
One way of positioning the actors of our case studies in a wider context is by using the tool, *Hyphe*, to collect a set of data which is also termed a *corpus*. Hyphe harvests data from web pages based on a chosen *depth level*, i.e. layers of hyperlinks to be crawled on a predetermined website. In our case depth level was set to 1, in that we would otherwise acquire an overflow of irrelevant websites, which would be a cumbersome process of filtering out. The purpose of using such a tool is to build a web corpus through an iterative process of crawling websites surrounding HP that neighbours a seed list of websites surrounding HP. The protocol for this process is inspired by a study by Anders Munk (2014) and can be found in Appendix C. The purpose is to generate an overview of the digital landscape of hydropower in Nepal as well as internationally. Locating and analysing *issue-networks* on the Internet based on webpages, allows this research to stage how HP is narrated on an international stage online (Marres & Rogers, 2004, p. 1). Thus, we have opted for such in order to be able to map out the various themes that would present themselves to us through the data harvested through Hyphe. In other words, each hyperlink gives another lead into the connections and disconnections existing between HP actors.

One could criticise the date harvested through Hyphe for being rather Western-centric based on the national origin of websites on the seed. We have opted for such an approach for various reasons, which are further explained in Appendix C. However, in short the inclusion criteria have been chosen based on practical limitations such as our own

[1] This quote is from an article that takes it outset in websites where edges are defined by being hyperlinks, but as earlier stated this definition depends on the type of data that is visualised. Moreover, edges may defined as being more than one type of interaction within the same network.

language skills and thus our ability to read the websites. Moreover, websites have been chosen from countries where big HP sectors exist, thus, countries that have considerable experience with HP.

The Hyphe data was visualised in Gephi using a spatialisation algorithm called ForceAtlas 2. It was set to *LinLog Mode* which spatialises nodes logarithmically as the map would otherwise appear rather hairballed. Moreover, all uncrawled websites (nodes) was deleted as the majority of them were irrelevant to the subject of HP. Lastly, edge weight[2] was set to the same value as the number of hyperlinks inherent to the respective edge, thereby varying the degree of attraction of all edges. Configuring these three parameters as described made the most noticeable difference in unfolding network and separating clusters (map 2). Although most clusters are easy to identify, we chose to apply the modularity algorithm in order to make them stand out even more.



Map 2: a digital overview of an international HP landscape

By attaining a digital overview, this investigation can explore the ways in which such a map can be analysed. As an example, the light blue nodes, allocated in two different clusters, consist of the World Bank, The International Monetary Fund, The Department of Electricity Development (DoED) and the NEA, but as they share edges they may be considered allies.

[2] the degree to which the edge draws two nodes together

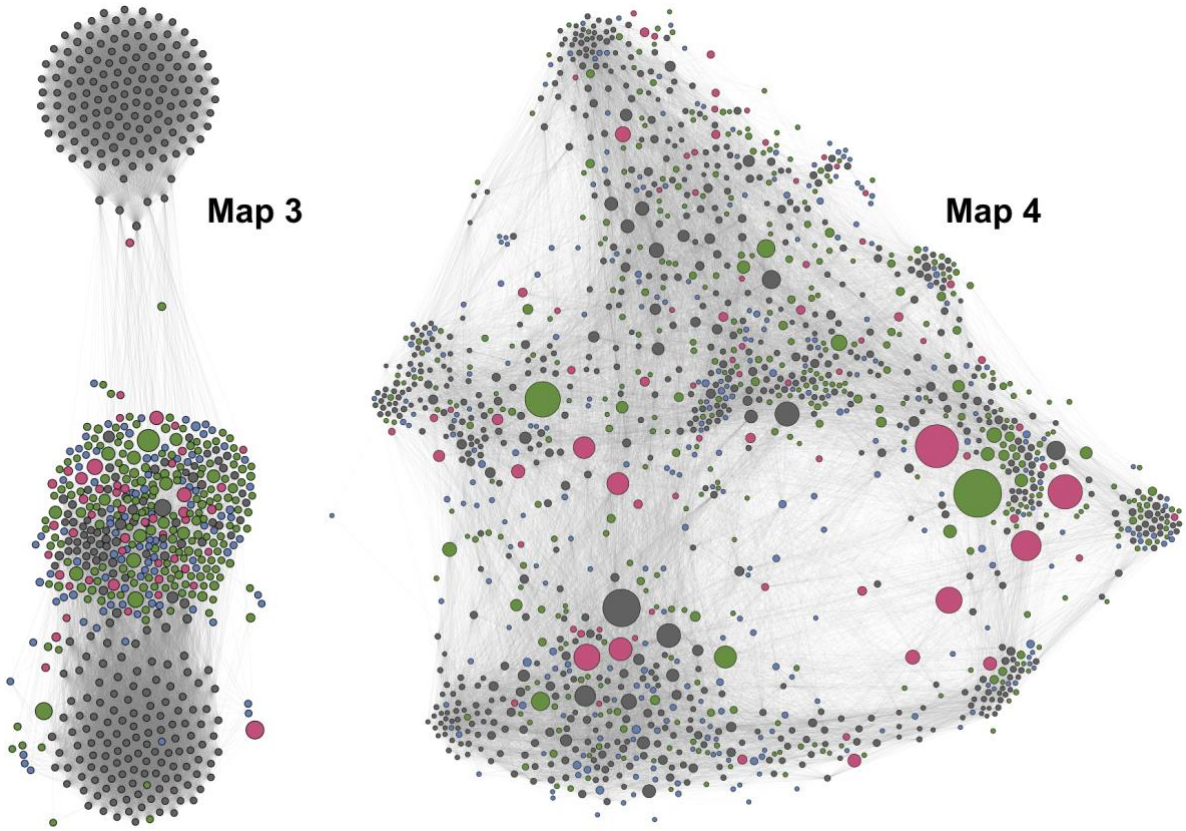
7.3.2 The Academic Field of Hydropower

Approaching a subject such as HP can seem incomprehensible at first due to the sheer magnitude of issues and perspectives belonging to different disciplines of academia. Even after having defined an area of interest within the many topics connected to HP this is not an easy task, mainly due to the initial unfamiliarity with the used terminology and use of keywords. Reading abstract after abstract provides an understanding of the link between keywords and issues, but it still incites the question as to whether there is an easier way of assessing the digital landscape of academia that address' HP? This question points at an analysis revolving around various publication spheres in academia, i.e. who the major publicists are, where academic articles on HP is published, and how publicists, and articles relate to each other via a reference network. This second strand constitute social research within the limits of an online medium (Rogers, 2017, p. 77) which in our case is the database of Scopus, which have been chosen for reasons explained in detail in Appendix D.

ScienceScape is a visualisation tool created by *SciencesPo Médialab* that can provide an answer to these above questions. The programme, which is designed to run in a browser, contains a variety of visualisation tools such as *keywords over time* and different types of vector spatialised networks which may be imported into Gephi for further configuration. ScienceScape is compatible with CSV formatted files (Comma Separated Values) from one of three scientific databases: *Scopus*, *Web of Science*, and *PubMed*, however, Scopus is the only one that allows the user to work with all the applications in ScienceScape. As mentioned we opted for Scopus as the source of data and extracted two different datasets or corpora: one, containing articles with an environmental focus and another containing technical articles.

After having qualified our corpora as described in Appendix D, the CSV files were imported into Reference Scape, which is a tool that visualises a map of nodes and edges where nodes can be either referenced articles (grey), authors (blue), journals (red), or keywords (green) (map 3 & 4). The reference node is only included if it is connected to a minimum of 10 percent of the total amount of references in the publications of the corpora. This means that the reference node with the least amount of mutual references to the overall network has respectively 128 references for map A and 92 references for map B. For the four types of nodes it also applies that they have to be cited for a minimum of respectively two, three or five times in order to be included. Furthermore, nodes that have less than two neighbouring nodes or, in other words, a degree-range (in-degree plus out-degree) less than two are excluded. This filtering is a default in Reference Scape and takes place prior to spatialisation. Based on a modified version of the spatialisation algorithm, ForceAtlas2, the reference

nodes are spatialised independently to the rest of the network followed by a spatialisation of the remaining nodes in the network. In practice these two specialisations are done simultaneously.



Map 3 and 4: two network maps spatialised in Gephi. Map 3 mainly contain environmental articles and map 4 mainly contain technical articles.

We arrive at two individual networks each of which is visualised on a separate map (Map 3 and 4, after import into Gephi). The only data filtering done in Gephi, have been to delete the keyword nodes ‘hydropower’ and ‘hydro power’ as these nodes were the only two search terms in the search queries to be included in every publication. If not deleted they would appear in the centre of each map and by far be the biggest nodes of the networks. This would have affected the spatialisation negatively as the networks would contract, hence, appear more hairballed. ForceAtlas 2 was used in Gephi to further spatialise the maps.

8. Analysis

The following subchapters will from different angles address the HP networks and actors of the Nepal HP landscape. Firstly, we will illuminate the role(s) which actors adopt and furthermore investigate into the types of agency that succeeds. Secondly, insight into the multiple roles and their origin will aid us in locating the individual actors position in HP networks on a national scale as well as HP networks that are formed around our case studies. In connection to this, we will present a digital perspective on HP networks and furthermore introduce *academia* as a somewhat secluded and yet ever present global actor with agency to influence the HP sector. We will proceed to draw on the two cases found in NHPC and BPC in order to analyse the particularities of issues that may be subject to generalisations. Such will be beneficial when looking into the stabilisation mechanisms, the black-boxing of actors and knowledge that altogether form these HP networks. However, there is no matter of course in how networks form. No absolute evolutionary path of HP development along with very few constants. The complexity and width found in these networks surpass most realms of comprehension which is why our resources is spend unfolding some of the many MoCs in depth rather than asserting to have included them all. Thereby, it is important to ensure a diversity amongst MoCs that has not been closed prematurely by a single hegemonic MoF (Latour, 2005a, p. 118). The ethos of this investigation will avoid such hegemonies in order to broaden our analytical vision.

8.1 From the Office to the Field

Exploring the HP landscape in Nepal was initially done through our contact with NHPC, where we were introduced to the EIA and IEE guidelines and the role these play in HP development. Chairman of NHPC, Kumar Pandey, gave us an introduction to the basics of the HP sector of Nepal in which NEA is one of the key players. Discovering this actor early in the process, helped us understand HP development in detail. The monopoly bestowed to the NEA as electricity distributor and the complexities in private intervention into Nepal's HP development. Another important contrast, which we discovered was uncovered in that Pandey is in fact the vice-president of IPPAN. Thus, he is capable of standing in opposition to the NEA. By opening the door to these key elements of HP in Nepal, we felt equipped to dive further into the theme of sustainability. Prior to leaving for our first field trip to the Indrawati River to visit the two HP projects of NHPC, we formulated interview guides for locals as well as NHPC employees and discussed expectations in regards to the amount of access we would be given to the field. As a result, we were rather nervous as to whether we

were properly suited to enter the field. With only second hand knowledge on HP in Nepal as well as limited insight on the history and reality of the HP plants we were about to visit, we decided to approach our first field trip in an explorative fashion. By doing so, we believe in hindsight that we were able to gain confidence in the field and learn enormously by simply 'letting the actors speak for themselves'. In other words, we did not initially attempt to lead dialogue in a certain direction nor did we try to set an agenda other than to explore the different perspectives on environmental assessment. Instead, we gave the people on-site at IHPP space and time to reveal their position and voice in the HP network in their own words. We believed that introducing us to the NHPC employees at the HP plant in this manner would familiarise us with them and perhaps ease trust between us. Importantly to note is that we went on this trip without an interpreter, thus our options, in regards to interviewing, were severely limited. Since, we did not wish to make use of NHPC employees as main interpreters as that would generate a conflict of interest that we did not want in our research.

Upon our second trip, we were determined to talk to locals in the area of both IHPP and LIHPP and work diligently to gather as much data as possible, as we were unsure if we would be given the chance to visit the site again. This time around, we had a personal interpreter with us, who would assist us by stepping into the many roles as our main interpreter (i.e. translator of both language and culture as well as a facilitator). This second trip strengthened our investigation profoundly as we began to understand the difference between the stated goals that are (supposedly) met in the EIA of IHPP and the reality experienced by the concerned public. The EIA report and the people local to the HP plant provided us with contrasting statements. One informant spoke of NHPC's intentions and how communication was disseminated. He described that in the beginning of construction, NHPC assured that people living within a one km radius of the powerhouse would receive electricity. He and others had a written agreement with NHPC, yet even long after power generation had commenced they did not acquire electricity. It appears that only due to public pressure in form of protests, the promises given by NHPC came to fruition. However, according to Pandey this issue between NHPC and members of the concerned public emerged as the NEA, who is responsible for electricity distribution, did initially not meet their commitments of providing local villagers with electricity until protests arose. Meanwhile, another local stated that she and her husband used to own the land where road access to powerhouse has now been constructed. They were not compensated in any way for giving up land for the road. Furthermore, she explained how they used to live 10-15 minutes away. One day when NHPC representatives came to their fields, they saw that afterwards all agricultural goods had been destroyed (i.e. grapefruits, oranges, lemons and rice fields). These statements are contrary to what is mentioned, or perhaps rather these claims are

absent in the EIA report. While many issues due to HP development were voiced, there seemed to be a general agreement amongst the villages that we approached that the benefits of HP outweigh the cost. During this second visit, we stayed overnight and could therefore gain a deeper understanding of the relationship and history between NHPC and the people local to IHPP and LIHPP. The issue of LIHPP was further explained to us, by locals as well as employees, that the project had experienced severe complications causing it to come to a halt and currently be delicensed for construction. According to NHPC employees it was mainly poor management that lead to the demise of the project, while locals were in complete puzzlement as to why the LIHPP had stopped its construction. Later when asking Pandey and Timilsina about this matter, it was revealed that the former NHPC administration had indeed suffered from poor management and resulting in LIHPP to be idle. Amazingly, neither the Chairman of NHPC, Pandey, or the NHPC employees at IHPP whom most are local to the area had provided any information to the local communities about the current situation of LIHPP. This emphasises our suspicion that there was a large informational gap between the locals of the area and NHPC. Additionally, it became clear that matters such as gender issues were not attended to by NHPC. The few women that we gained access to conduct interviews with were expressing concerns previously untold by the male locals. This could be a sign that their voices were not heard during the initial scoping phase[3] and not till this point either. The gender issue was later pointed out by Vice-President of BPC, Pratik Pradhan, who mentioned that gender issues were lacking in the NEIAG and therefore in HP projects in Nepal (Pradhan, P. M. S. 2018, BPC interview, 26 April).

Upon our return to Kathmandu, we had acquired more knowledge on HP technicalities and some of the socio-technical issues connected to HP. In addition, more actors had been revealed to us and we, thus, began to establish contact to some of these HP actors. We gathered more points of views by interviewing team leader, Dev Gautam, of the NGO, Care, which opened a door into a different perspective on HP development.

Whereas we had easy access to Pandey of NHPC, our contact to Pradhan of BPC was characterised by being somewhat challenged by Pradhan's busy schedule that left us with small 'windows' of access. The degree of admission to information was unexpectedly high at both companies as well as the willingness to help us. We were somewhat perplexed by this and it left us wondering as to why this was the case. Perhaps it reflected pure interest or perhaps an expectation of good publicity.

[3] According to the NEIAG, the scoping phase facilitates public participation where concerns and expectations are to be heard.

Upon arriving at AHPP, we knew that this would be our only trip to the site due to the 12 hours it takes to get there. We were therefore determined to make it count. Initially, we experienced a freedom to roam around on our own at the dam site, which we had not encountered during our visits to IHPP. Furthermore, we were not followed around by HP employees when talking to locals in the surrounding communities. The atmosphere around AHPP was however different, as our first interview descended into chaos, when an increasing number of young men showed up and frequently interrupted throughout the interview. It was obvious that expressing criticism toward HP was clearly frowned upon as we witnessed. One person was critical about the HP project by voicing his concerns about the earth integrity and structure during and after construction: “The disturbances of the land structure has people living in fear of landslides.” (The Concerned Public 2018, AHPP Interview, 16 March). Thereafter he was promptly told to be quite by another man of the village. Apparently, there was more tension looming here than our preceding visits to IHPP and LIHPP. Furthermore, we were presented to the organisation AKWUA. A new form of public voice in the HP landscape with its focus on land and water rights. According to Pradhan, BPC had to negotiate with AKWUA when AHPP was to be upgraded from a capacity of 5.1 MW to 9.4 MW, as an apparent discussions emerged on how big share of the water should now be used for irrigation (Pradhan, P. M. S. 2018, BPC interview, 26 April). Here it was perfectly illustrated how concerns or viewpoint surrounding a particular issue collide. All of our field visits revealed issues in networks within networks, thus a multi-layered structure of MoCs. The presence of spokespersons and intermediary actors, who serve to stabilise the relationship between HP companies and local communities, revealed some of the complexity surrounding HP development. A scenario began to emerge illustrating that public engagement only seems to occur through the voice of a few. All of these contributed to depicting a multifaceted landscape. This contributes to nuancing the field of HP with all its actors, the various concerns, as well as contesting knowledge around HP development and its benefits, which by now has stabilised as black boxed MoFs.

8.2 Formation and Exploration of Hydropower Networks

The documentation of observations and conversations, along with the subsequent reflections described in the above subchapter, provides the necessary basis upon which we may acquire a deeper understanding of how actors and networks within HP development are formed and stabilised. Additionally, this illustrates how the dynamic nature of networks may result in a subsequent destabilisation. Aided by Callon’s translation process, we will shed light on the contextual mechanisms which enables such formation to take place. Additionally,

in the spirit of ANT terminology, deconstruct the actors which by now has stabilised to the degree where they appear black boxed. This is performed in order to understand the bigger picture that is the HP network of Nepal. Such is easier said than done. Whenever one believes to have identified the black boxed nature of actors that make up the 'glue' that holds the heterogeneous network surrounding HP together, it follows that new layers of networks that influence the translation process is discovered. We are dealing with a level of complexity that goes beyond the somewhat palpable relationship between the concerned public and HP companies, where also government interests, NGOs, international banks and funds, as well as the technical features of HP plants play a role in how the HP network takes form. Implicit to such a complexity is the fact that not all actors will be included. The modest aim of this chapter is therefore to produce a general understanding of HP network formation in Nepal by, figuratively speaking, pricking holes in the outer layers of the onion in order to enable such exploration.

As an outset for 'deconstructing' the HP network into the four moments of translation, we will benefit from determining a set of actors that is believed to hold an integral part of the HP field in Nepal. Thereby, illuminating a vast array of relations to other actors in the network. As our main entry into the field is through firstly, NHPC, and at a later stage, BPC, these actors make up a natural point of departure. Prior to this, we acquired preliminary knowledge on the field and in particular through a recent study by Munch-Petersen (2017). By doing so it revealed several very influential actors in the HP field of Nepal who hold a multitude of concerns, especially in regards to the legislative actors of HP development. In addition to this, one MoC in particular was repeated in social circles. This MoC is expressed in the term 'load shedding'. This is a term used for the deliberate shutdown of a power distribution system in order to prevent failure of the entire system. This causes electricity cuts, which frequently occurs in Nepal. Through our contact with NHPC, we were lead to the government organ of NEA. We were curious to explore how the role as a sole distributor of electricity affects private HP companies and in turn the concerned public. Upon entering the field of HP, it became clear that for the integrity of the research, it was valuable to consider a protocol to navigate amongst actors and their perspectives. The protocol was not only meant to identify MoCs, but also to properly distinguish between differing viewpoints within MoCs in the HP landscape in order to avoid uncritical assumptions. This is when the mechanisms embedded in the four moments of translation becomes relevant as they unfold the process of empowering actors and creating black boxes as well as establishing MoFs. Thus, providing a sort of 'internal unfiltered view' of the network as a whole.

The first moment of translation is *problematisation* and has already been mentioned in the term 'load shedding', in that power cuts or the general lack of electricity is a problem for most Nepalis. Our initial engagement with NHPC and BPC lead us to believe that government legislation, regulation and monitoring were the main issues for preventing progress within Nepali HP. These concerns were echoed by BPC and seemingly other HP companies, and, moreover, confirmed by several reports and academic articles on the matter (Sovacool et al., 2011, pp. 3473-3474; Sharma and Awal, 2013, p. 691; Munch-Petersen, 2017). This problematisation connects concerns belonging to NHCP and BPC with those of other actors and reveals the OPP, when all actors acknowledge their own indispensability in solving a common problem. The most noticeable way in which the concerned public become indispensable is by surrendering land for HP plants to be built. The government becomes indispensable when it had to change regulations, so that private HP companies were allowed to purchase more than 75 ropanis (3.82 hectares) of interconnected land area, since less than 75 ropanis of land is insufficient for the materialisation of any commercialised HP project (Pradhan, P. M. S. 2018, BPC interview, 26 April). HP companies becomes indispensable by being the ones constructing HP plants. Furthermore, technical specifications such as dams, penstock tunnels, and turbines, all amount to indispensable features, because they ensure the actual production of electricity. Lastly, the ecosystem geographically facilitates HP development by the indispensability of river flows emanating from the Himalayan mountain range.

The second moment of translation is *interessement* at which point a mutual problem has been identified, wherein the actors need motivation to pass the OPP. The 2001 HDP published by the government of Nepal explicitly liaises how generating electricity will "(...) result in the economic development, industrialization, flood control, environment protection, [and] creation of employment opportunities in the country (...)" (The Hydropower Development Policy, 2001, pp. 2-3). Arguably, this quote contains goals that incites all aforementioned actors in various ways. This liaising is facilitated by the Nepali government and, as such, the government directs the actors through the OPP by arguments served to convince the actors of how they benefit individually. Doing so successfully, firstly, confirms the problematisation and, secondly, ensures the *enrolment* of actors, which constitute the third moment of translation. The latter stage entails accepting their individual roles as indispensable actors in HP development. An example of such should be understood as members of the concerned public near IHPP and LIHPP were promised manual labour employment during the construction phase and even employment as operators after the operationalisation of IHPP. This is not a predetermined role, but rather something they feel entitled to upon a series of negotiations among themselves, HP companies, and the government. Explicitly, this is seen in the assessment reports (EIA and IEE), which are the

prerequisite studies which have been conducted on the basis of the legislative framework dictated in the NEIAG, EPA, and EPR. Thus, the focal point of all the liaison and negotiation is the legislative regulations that are passed by the federal parliament with the government in the leading role. In this sense, the government may be perceived as the 'overall' spokesperson of the HP network of Nepal. The government indirectly speaks on behalf of all actors mentioned in this section, since they have to approve the assessment reports prior to the commencement of any construction work (figure 6).

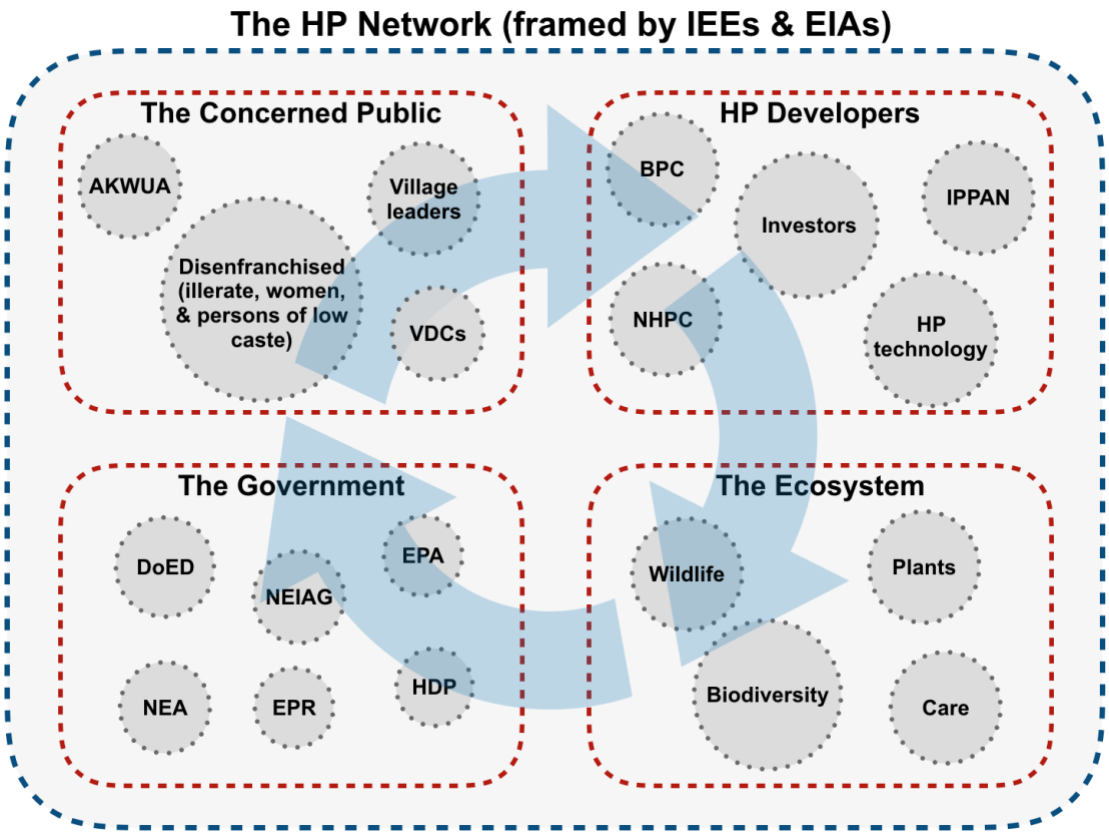


Figure 6: concise figure of the HP Network in Nepal, which is framed by government approvals of EIAs or IEEs. Within this network, we have identified four main actors: the concerned public, HP developers, the government, and the ecosystem. However, these actors are in themselves networks consisting of actors. The dotted lines and the three arrows signifies the dynamic nature of the overall network, since some actors may move into other networks or are part of several networks at the same time. NEA is for instance an actor in the government network, but at the same time also an actor within the network of HP developers as NEA is in charge of government owned HP projects.

By approving the reports, the government mobilises the entire network around one goal that encompass the interests of its actors. In connection to this, it is important to emphasise that each actor is a network in itself that has gone through a similar translation process. In these series of translations other spokespersons have been present whether that is in the form of VDCs, IPPAN or something or someone else. In other words, these are the holes of the outer layers of the onion. As a spokesperson, the government does not communicate directly

with all actors, but through spokespersons within actors. This understanding is derived from the fact that actors are indeed networks made up of yet deeper levels of actors. The only difference being that actors have stabilised as such at an earlier stage. The amount of stabilisation of these networks may be so immense that they appear black boxed.

8.3 Digital Exploration of Hydropower Networks

At this moment, we have unfolded the translation process that takes place in the overall HP network in Nepal as well as opening up the black boxes of particular networks surrounding our two case studies. We will proceed to a broader perspective of HP development. To do so, this chapter will examine the role of academia in HP development by perceiving it as an international actor capable of pushing Nepal in a sustainable direction. Such a preliminary assessment is based on variables in HP development being influenced by operations and legislations from beyond the borders of Nepal, e.g. IHA's influence on NEIAG. Furthermore, we will examine how HP actors in Nepal position themselves online in regards to international HP actors, thereby introducing another perspective on how these actors to interact digitally as it increasingly reflects the offline world. The idea of such online-offline dynamics is the true value of digital methods in the pursuit of understanding the digital field in order to make proper use of the information stored there (Munk, 2013, p. 290).

8.3.1 The Segregated Spheres of Academia

Our digital exploration initially began by exploring whether there was a noticeable difference between the volume of published articles over time in the corpora of data harvested from Scopus (chart 1). This provided the first interesting finding as it appears that there is an increasing academic interest in articles with an environmental focus. Such is reflected in the 2017 peak, where 188 articles out of the 2000 most cited articles were published. In comparison, articles of a technical nature peaked already in 2014 with 198 publications. However, they have since declined with only 12 articles among the most cited in 2017 and non so far in 2018.

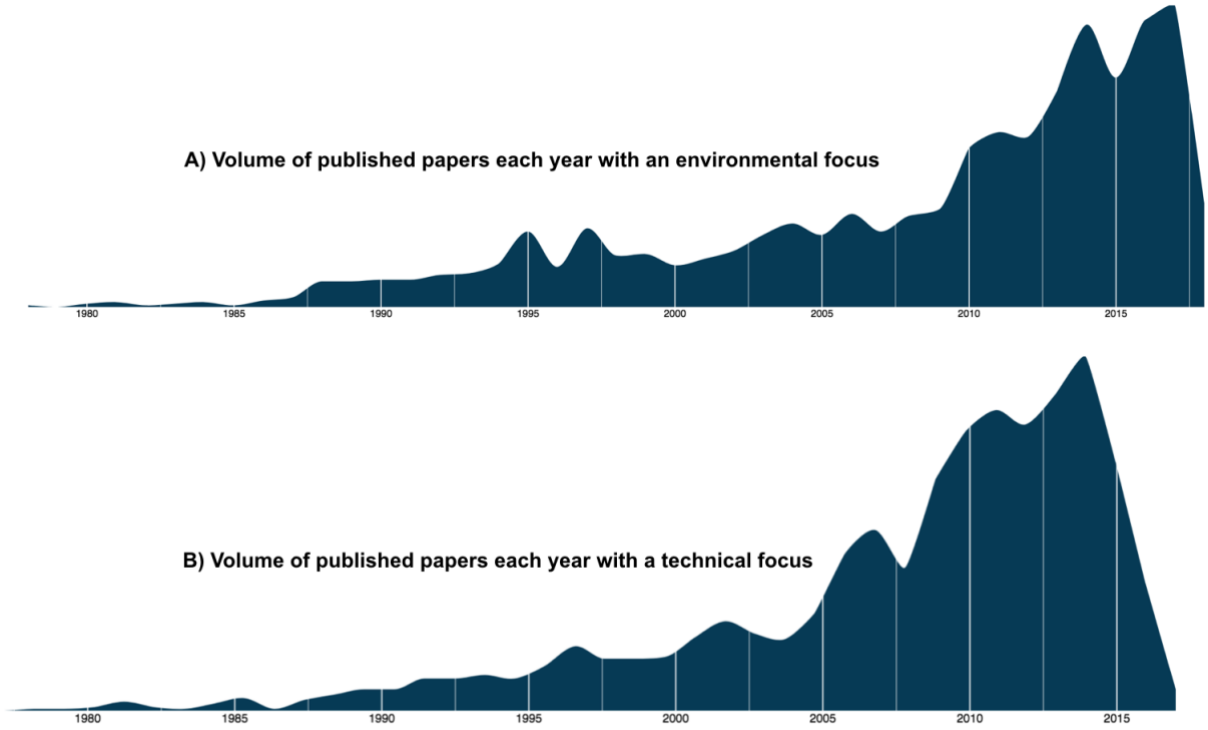
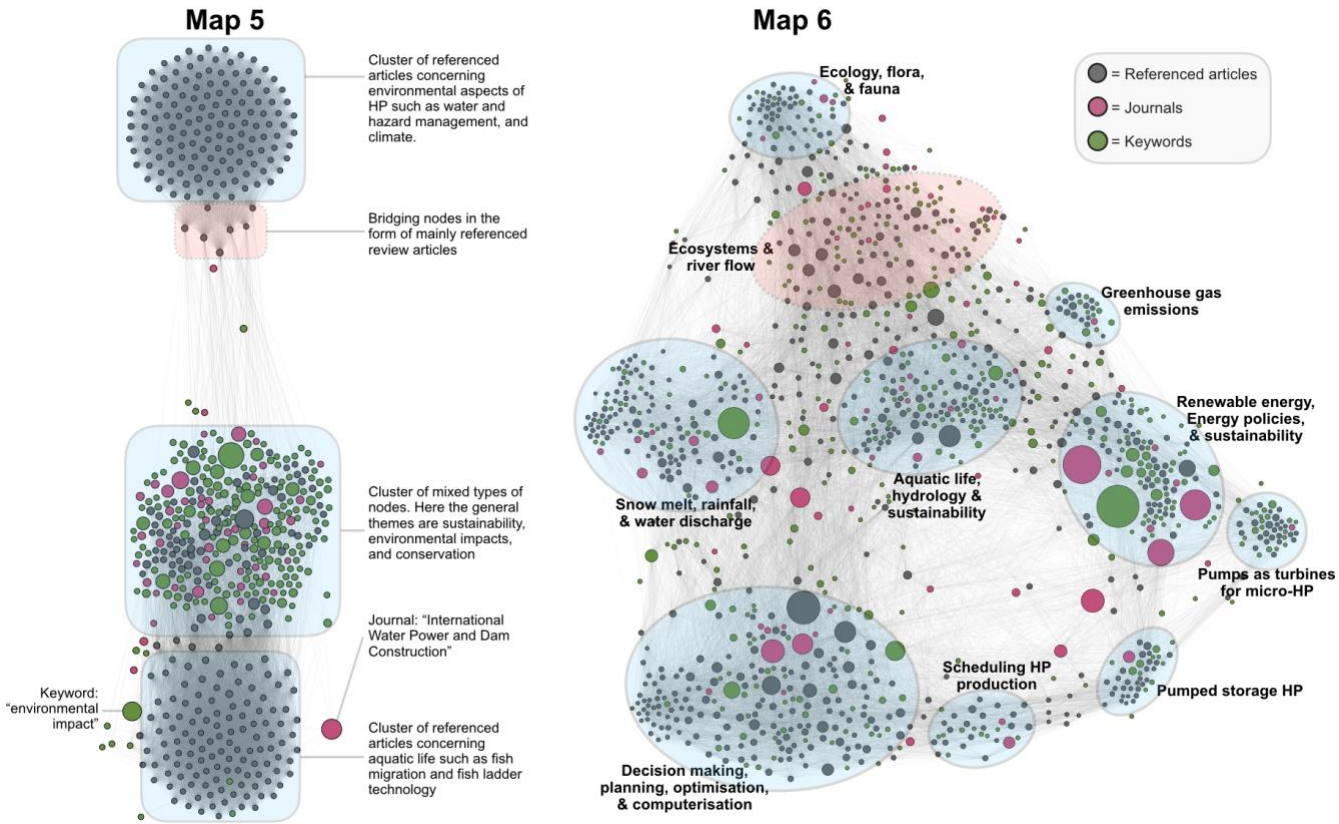


Chart 1: comparison of the most cited articles over time. Data was harvested in April, 2018. (visualised in ScienceScape)

These figures tell us that academia, seen as an actor, is advocating an agenda with a greater focus on the environmental impacts caused by HP development. The gravity of this agenda seems to have strengthened as of 2010, which marked the point where the graph began to climb. This was also the year when IHA published their *Hydropower Sustainability Assessment Protocol* with the purpose of providing an international framework for HP impact assessments (International Hydropower Association, 2010, p. 5). Pushing such an agenda has surely had an effect on investors who, as a result, present HP companies with a range of demands surrounding environmental impacts and mitigation before HP projects are funded (this theme is further elaborated upon in chapter 8.6.2). On the technical side (chart 1, B), the declining interest may be interpreted as a 'stabilisation' within technological research, understood in the sense that the greatest breakthroughs happened over the period of 2010 to 2015.

Chart 1 has pointed at some interesting differences between the two spheres of HP. Nevertheless, a diagram in itself is not sufficient for exploring the world of academia. Instead, we will scrutinise the Gephi maps introduced in chapter 7.3.2. Visualising the same corpora of data as spatialised maps provide a clear differentiation between them. In map 5 and 6, nodes are sized according to *occurrences count*. The clusters are divided into themes or subjects (blue areas), while some bridging areas have also been marked (red areas). Map 5 is characterised by having two very well-defined clusters in the top and in the bottom of the

map only consisting of reference nodes. Map 6, on the other hand, has several more or less well-defined clusters. This tells us that the technical literature of map 6 is divided into multiple subcategories some of which are extremely specialised, such as articles addressing “pumps as turbines for micro-HP”. Meanwhile, in map 5 the literature is much more holistic, which may be interpreted by qualitatively scrutinising the middle cluster. The content of which encompass both keywords such as “resettlement”, “biodiversity”, “sustainability” along with journals such as “International Journal on Hydropower and Dams” in addition to articles addressing sustainability, environmental impacts, and conservation. Nevertheless, the top and bottom clusters almost exclusively consist of referenced articles and are almost completely disassociated with any journals or keywords that for the most part belongs to the central cluster. This peculiar positioning is due to bridging nodes between the central cluster and the top and bottom clusters. The biggest nodes are often keywords, journals, and referenced articles that appeal broadly and may be used in many contexts, such as the keyword “renewable” which is the biggest green node on both map 5 and 6.



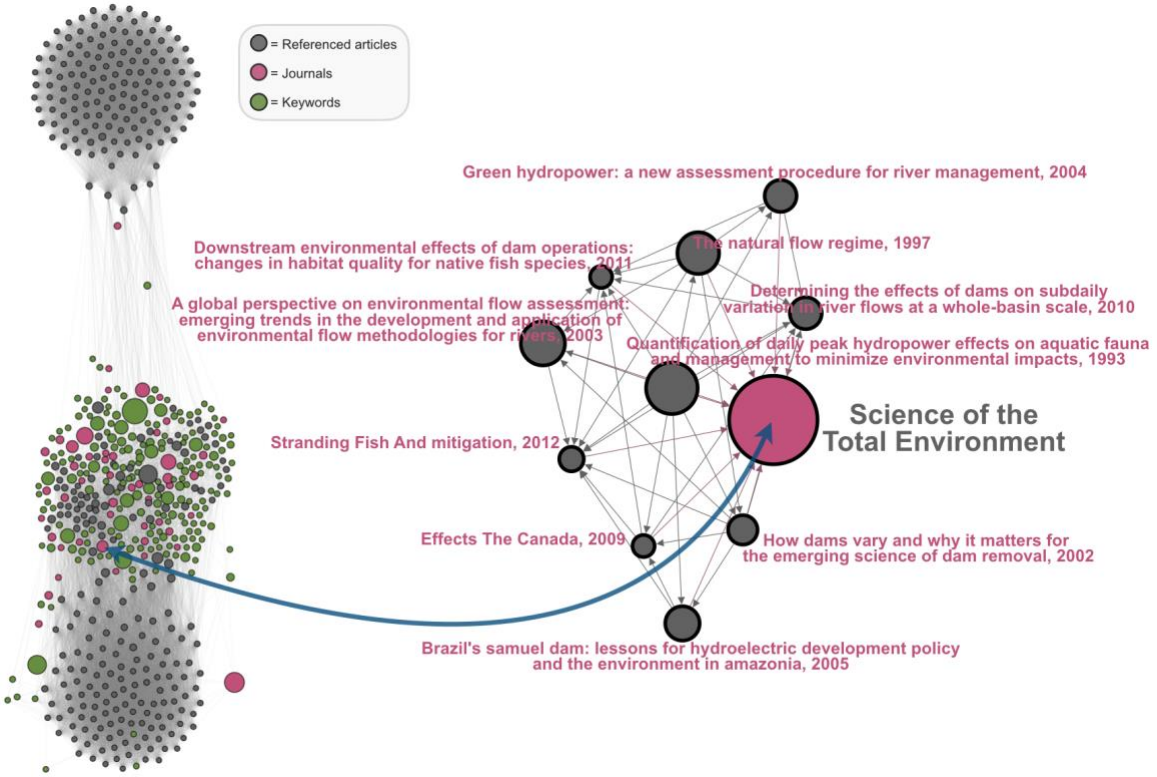
Map 5 and 6: spatialised Gephi networks based on Scopus data. Map 5) articles with a predominant environmental focus and map 6) articles with a predominant technical focus. The original ‘author node’ has been removed from the networks as the focal point is themes and topics, thus making the networks tripartite. Blue areas are clusters and red areas are bridges.

The first finding is seen in the difference in amount of clusters, hence the respectively connection and segregation of knowledge. In map 6 there are nine different clusters each

representing a scientific arena for articles and journals surrounding a specific issue within engineering. This comes as no surprise as engineering, like many other professions, is also becoming increasingly specialised. Although, map 5 is less clustered and is, as already argued, more holistic, the top and bottom clusters act as two antipoles, since they only share very few edges. These sharply segregated clusters within environmental articles (map 5) constitute our second and arguably most interesting finding. The segregation arises due to the fact that map 5 does in fact include articles belonging to the natural sciences. Such is represented by the top and bottom clusters each of which could be defined as single actors by the look of the nearly perfect circular shapes, which indicate strong edge connection and stabilisation. In other words, the nodes of these clusters would to a greater degree be dispersed on a map if they were part of a corpus comprised of articles exclusively belonging to the natural sciences. Thus, in regards to HP there is a clear segregation between the sphere of humanities and natural sciences in academia.

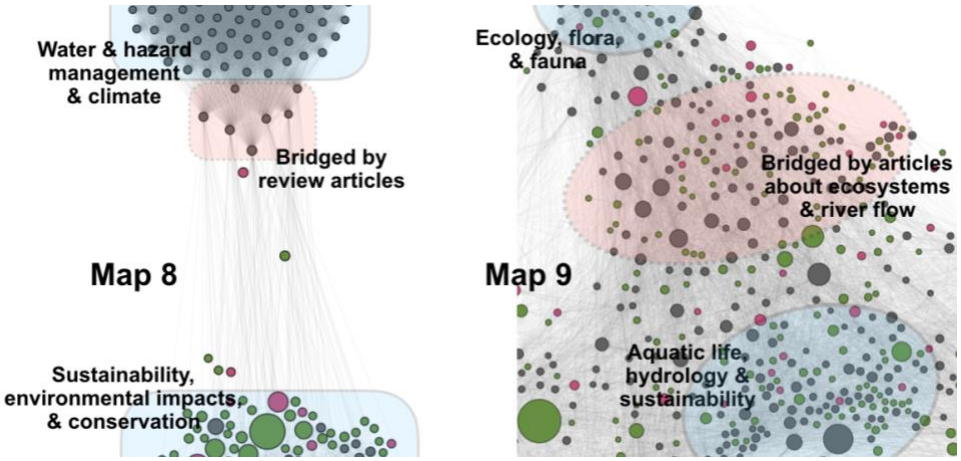
However, if academia wants to advocate, what might be termed a *socio-technical agenda*, we will benefit from looking into how journals link out to referenced articles and vice versa. The journal *Science of the Total Environment* (Map 7) is connected to referenced articles, which for the most part focus on the natural environment. However, it also contains a few more technically-related articles on dam and the fish ladder technology. This small *ego-network*[4] is positioned in the bottom of the middle cluster near the bridge to the bottom cluster. Thus, unlike the more centrally positioned journals, *Science of the Total Environment* references a wider spectrum of scientific articles. Chief editors of Journals are, without a doubt, conscious about their readership and what segment they target. However, perhaps they are not aware of how they themselves, as journals, are positioned through references to other actors in the landscape of academic literature surrounding HP.

[4] Ego-networks consist of a focal node, 'the ego', and nodes that are directly connected to the ego-node



Map 7: the journal "Science of the Total Environment" as the ego in an ego-network, i.e. nodes with direct edges to an ego-node.

Map 8 and 9 may aid in achieving such an understanding, since technical and environmental literature spatially appear far apart on the maps. Thus, indicating that this is also the case in academia. Pushing a socio-technical agenda in academia may to some extent include interdisciplinary collaborations between researchers/authors, which in terms of digital mapping means positioning oneself in bridging positions between clusters of different themes. In relation to map 6, we have earlier argued for the prudency in having well-defined clusters and thereby also bridging nodes.



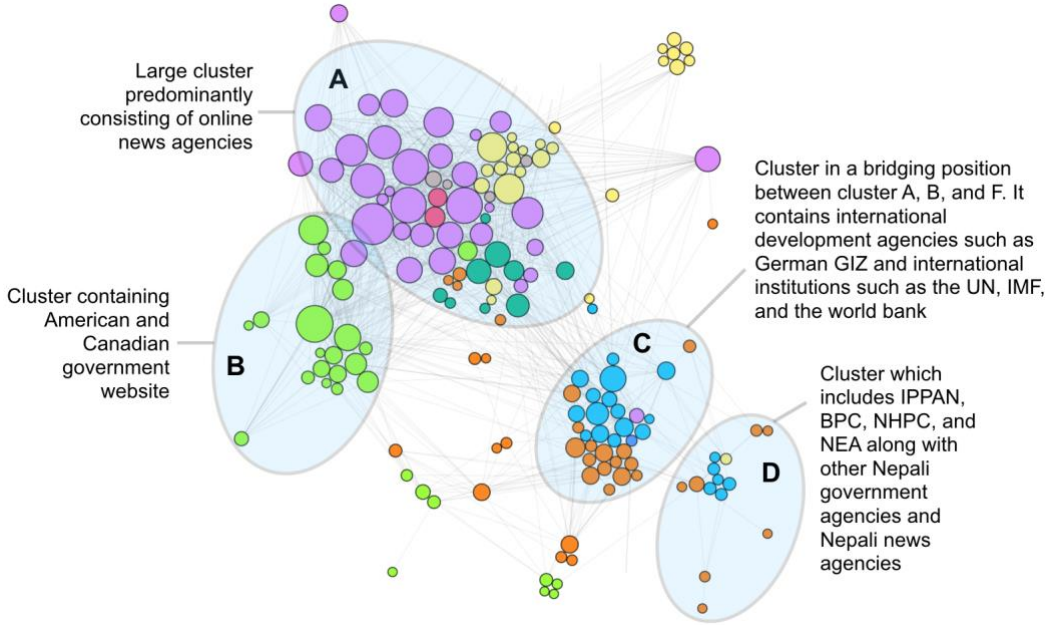
Map 8 and 9: zoomed-in extracts from respectively map 5 and 6 showing two different ways of bridging themes.

In terms of bridges, it is interesting to see how the two spheres of academic literature bridge their clusters. In map 8 clusters are bridged by review articles, whereas, in map 9, the clusters are bridged by nodes representing articles about ecosystems and river flow. The latter mentioned themes apparently make up a shared bond between the clusters. Therefore, it is primarily review articles that bridge the humanities with natural sciences, but looking at the natural sciences in isolation, articles with interrelated themes also appear as bridging nodes. Bridging the segregated academic spheres is not easy, but an outset could perhaps be through an advocacy of greater interdisciplinary science as a supplementary to the cross-disciplinary approach often seen in review articles. This point will be unfolded in relation to the Hyphe map in the end of the chapter

8.3.2 International Actors in Hydropower

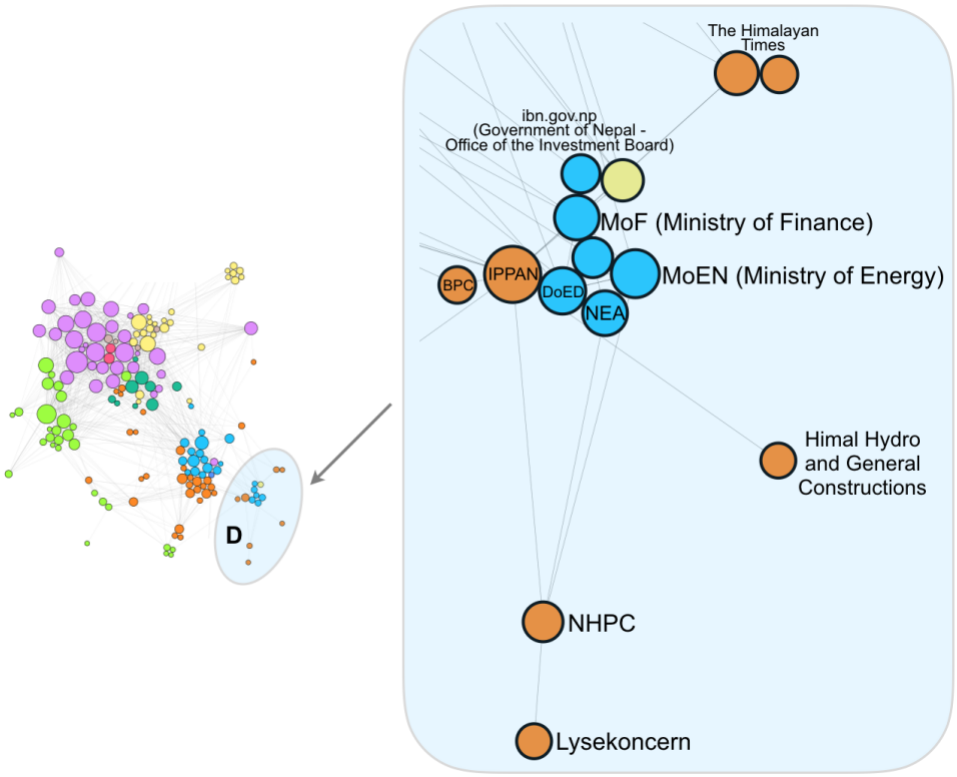
This research continues within the discipline of digital mapping, while moving from academic relations of articles, keywords, and journals into that of hyperlinks. Here our protagonists are BPC, NHCP, NEA, DoED, and IPPAN. However, this research was initially aware that these actors would not logically align themselves centrally on the map. Instead, we anticipated the HP network to show interesting and perhaps surprising connections or disconnections between actors in which themes could be drawn from such. This subchapter will attempt to unpack the findings of the digital landscape of HP.

Map 10 displays a network in which clusters have been identified based on common features or backgrounds shared by their actors. Such aids to classify clusters and the translation processes that connects them.



Map 10: spatialised Gephi networks of four depicted clusters, which have been highlighted based on analytical relevance.

The actors central to this investigation are located within one cluster, whereas the remaining three clusters, nevertheless, have a part to play in this HP narrative. The clusters all have clear themes, which aid the storytelling of this map. Cluster D contains a number of key actors of this research in form of BPC, NHPC, IPPAN, NEA and DoED, yet does not appear to have a significant position in the network as it is positioned in the periphery of the map. The largest cluster in the HP network is cluster A, which mainly is occupied by online news agencies with the most notable being Buzzfeed, Reddit and VOX. Bordering next to this is cluster B that is occupied by Canadian and American government agencies, where bridging nodes between these two clusters are a mix of news agencies and government sites of the two aforementioned nations. This could indicate that these news agencies are connected to government agencies, because they are reporting on them and their operations. These two clusters are also connected to cluster D, however cluster C is in between and seem to act as a bridge. Cluster C contains development agencies (e.g. Gesellschaft für Internationale Zusammenarbeit) and international institutions (e.g. UN, International Monetary Fund, the World Bank etc.) and shares many connections between A, B and D, which explains its position on the map. The most interesting elements of the map are how our offline actors position themselves digitally within cluster D.



Map 11: cluster D in close up view

In map 11 cluster D, containing the main actors, is put into focus. Notably, BPC is located slightly outside the cluster consisting of Nepali government agencies, such as DoED and NEA. In this constellation IPPAN serves to bridge BPC with these policy-makers. This could be interpreted in the sense that IPPAN is an intermediary between BPC and perhaps other HP companies and DoED as well as the NEA. The role as a liaison may be quite fitting to dub an association such as IPPAN, which does take into account the interests of BPC while perhaps IPPAN would assume the role of a spokesperson for BPC and other HP companies. Such a postulation can be supported by Pandey and his description of IPPAN as the link between government organisations involved in HP and the private sector.

By allowing our Nepali protagonists reveal an HP scenario it is clear to see the disconnections between actors. Another crucial aspect is that a map will depict an overarching controversy, notwithstanding several sub-controversies that also comprise the same map (Venturini, 2010, p. 806). Such may not be exactly the point in the disconnect between the international news agencies of cluster A and the Nepali government bodies and HP companies of cluster D. Nevertheless, it could be an indication that the development agencies and international institutions of cluster C are the gatekeepers for cluster A and D to access each other. This may be a display of a sub-controversy in that foreign news access to Nepali HP is regulated by these development organisations that amount to much of the

foreign investment in HP in Nepal. In other words, this indicates the role that such development organisations have for Nepal as they may serve as an access point and gatekeeper into the HP sector of Nepal. The role as gatekeepers is, among other things, being influenced by academia, which, as already argued, shows signs of advocating a greater socio-technical agenda. As a result, the entrance to the Nepali HP sector becomes increasingly difficult for HP companies, if they choose to ignore an all-encompassing approach to sustainability in HP development. Certain actors are seen to attempt to transform themselves into spokespersons. One such example has been highlighted in this analysis as IPPAN is situated as a bridge for BPC to government agencies in Nepal and vice versa. Our Nepali protagonists have unfolded an HP scenario that is manifold and which, in regards to spokespersons and gate keepers, are in line with our offline investigation.

8.4 Unawareness and the Natural Path to Development Expectations

The various interests unveil an otherwise disguised energy debate, where the concerned public fall victim for HP progress set by law-making that aspires to satisfy Nepali electrification needs and desires. At the 2013 Power Summit[5], representatives of the HP field were invited to participate at the Crowne Plaza Hotel in Kathmandu under the theme '*Hastening the Pace of Hydropower Development*'. Amongst the guests were HP developers, development experts, government officials, and foreign investors. During the discussions, the term *ayojanale prabhabit manchhe* or project-affected-people was repeatedly used to describe the people who are impacted by HP development (Lord, 2014, p. 118). This term may seem to be neutral and hold no particular affiliation, but it is central to consider the arena it has been used i.e. by educated and powerful people in a prestigious hotel in the capital of Nepal considerably far away from the actual concerned public.

Changes for the better implies building a common future on the basis of various MoCs where a prioritisation of the many concerns and viewpoints herein often result in the concerned public being is sacrificed (Lord, 2014, p. 112). This is counterintuitive, since public participation is supposedly ensured throughout the initial scoping phase of HP projects, where locals enter into negotiations with HP companies. This chapter will investigate scenarios such as this by uncovering the reality of public awareness and engagement in HP development.

[5]The Power Summit is a yearly recurring national conference convening representatives from the HP industry (Lord, 2014, p. 118).

8.4.1 Uneven Access to Disseminated Knowledge

Nepal's long history of HP would logically imply that the public would have expectations attached to HP. Nevertheless, we discovered that quite the opposite is the case. The public did not have many, or in some cases no concerns, when faced with HP development. One informant at AHPP, whose role it was to communicate between the local communities and the HP company in addition to being a local himself, stated that the locals "(...) did not know what questions to ask or what they should be concerned about, because they did know of the potential impacts that HP can cause." (The Concerned Public 2018, AHPP Interview, 16 March). As such, public concerns appear to be determined by knowledge or in this case lack thereof. This was the answer given by most of our informants, who had lived in the area of HP construction. Evidently, there are still Nepalis who are unsure of the reality of HP development and its effects on its surrounding natural environment and those who inhabit it. It is therefore likely that most households located in the areas of operational HP plants, or those in areas that are in contention to become home to HP projects, are not well-informed, and, thus, not fully aware of the implications of HP development. This informational gap clearly exists and is supposed to be accommodated through public hearings as well as initial negotiations regarding land purchase with concerned publics living around potential HP projects.

The case study performed by Munch-Petersen at three different HP projects, concluded, that many locals did not experience public participation despite various information disseminations taking place (Munch-Petersen, 2017, p. 16). In accordance to the EPR and the NEIAG, a 15-day public notice is required to be published in order for, firstly, HP companies to comply with legal requirements in regards to public participation, and, secondly, allowing for "(...) the local people and other stakeholders an opportunity to raise their concerns and offer suggestions which facilitates the identification of key issues to be included in the scoping report." (NHPC, 2002a, p. 17). This is an official parameter for all HP projects, yet this does not always have the intended effect. Whether the purpose of public participation, for the particular HP projects, is about providing information or seeking advice on possible environmental impacts, this aspect of the scoping phase is crucial for locals to engage in or simply to have their voices heard. In the EIA report for IHPP, different risk scenarios are described such as landslide zones and soil erosion as these factors need to be considered prior to construction (NHPC, 2002a, p. 21). Much of such data is conducted by a team of HP employees who also formulate the EIA report. In the process of doing so, public hearings need to be held and a public note should make preliminary contact with those local to the area. This public notice might be published in a newspaper that does not even reach certain rural areas, thereby excluding citizens of these areas to engage in the process

(Munch-Petersen, 2017, p. 17). This is noteworthy as, in the area of IHPP, 60 percent of the population in the local communities are illiterate (NHPC, 2002b, p. 3) and amongst women literacy levels are described as *extremely low* when it was assessed in 2002 (ibid., p. 34). Such a scenario of omission is not uncommon to the Nepali context. Exclusion during HP development is confirmed by Acharya, who claims that despite legislation being particularly about mandatory public participation in HP development it does not always materialise. Acharya claims that upon a public hearing those who are defined as project-affected-people are called upon wherein documents regarding impacts and intentions of the HP company is disclosed. (Acharya, P. 2018, HCE interview, 23 February). Nevertheless, he emphasises the rarity of these hearings, or other public consultations, actually including locals (Ibid.). He further clarifies that most of the local participants are elites or village leaders of the local communities (Ibid.), which arguably creates discrepancies in the final statements in EIA reports that ought to pursue a more holistic and approximated representation of concerns belonging to a concerned public. In the case of the unfinished LIHPP, it is evident how certain actors are silenced, in that the majority of the nearby villagers had no idea of the details of the HP project. An operator of IHPP stated that village leaders as well as leaders of the VDC were invited to a public hearing but he also stated clear doubt as to whether all villagers were properly informed afterwards (HP operator 2018, IHPP interview, 25-26 February). This statement was confirmed by several local men of one of the villages in the area to which they elaborated that "(...) they [i.e. village leaders/intellectuals] didn't see the [EIA] report, but disseminated information given to them [by HP developers] about the report." (The Concerned Public 2018, IHPP/LIHPP Interview, 25-26 February). This is obviously a very restricted form of information delivery from NHPC, who, furthermore, fail to facilitate public participation for all members of the concerned public. Applying previously introduced ANT notions on voice and visibility in this interaction between these actors will reveal underlying power structures. By following this thought, visibility shows this investigation that the village leaders and intellectuals become spokespersons for the rest of the concerned public as cultural norms has dictated them to accept its elders (i.e. mostly men) to become leaders of communities in Nepal. Thus, the patriarchal society has a strong influence on the positioning of village leaders as spokespersons, which in turn results in uneven access to the disseminated knowledge process occurring during the scoping phase.

8.4.2 The Neglect of Micro-Actors

NHPC and other HP companies define a project-affected people, which subsequently excludes a part of the concerned public and strips them off their right to participate in the

scoping phase. This concurs with the study of Munch-Petersen, who also uncovered that many locals had "(...) no real influence on decision-making processes in regards to HP development (...)" (Munch-Petersen, 2017, p. 4). Thereby, revealing a knowledge dissemination that "(...) leaves very little room for negotiations, especially if information is disclosed at a very late stage in the planning process." (Ibid). The EIAs allow for public engagement in the scoping phase, where a concerned public and perhaps even NGOs are included in the process of HP pre-construction for the first time (Munch-Petersen, 2017, p. 9). Yet, many articles on HP in Nepal believe that this is a one-way information channel that does not allow for proper influence on decision-making (Ibid., p. 10; Cernea, 2004, p. 47). A reality that was illustrated to us by those local to IHPP:

> "No one came and talked to us. We have to look out for ourselves and our own interests. Whatever happens to other people [of the village] will happen." (The Concerned Public 2018, IHPP/LIHPP Interview, 25-26 February).

> "One day, they [NHPC] came with their equipment. They hadn't communicated their intentions in advance before arriving here." (Ibid.).

These are examples of a concerned public, who experienced the pre-construction phase and initially operationalisation of the HP project proceeded without considering their concerns. Additionally, to this scenario, the village leaders and intellectuals reaffirm their powerful position through the Nepali patriarchal society and themselves as spokespersons. This transformation occurs in such a way that negates the possibility for other locals to have an influence in public participation in HP development. One example can be found in AKWUA, who enrols its constituents by summarising the interest of many and thereby translating the interests into common proposals and demands. Yet, similarly to the village leaders disseminating information onto the remaining community, AKWUA is also at fault of misusing its role as a direct link between a concerned public and the HP companies. An example of such was recorded when informants did not agree with the hypothesis that the river stretch between the AHPP dam site and Kali Ghandiki River dries up during dry season. This shows the power of a macro-actors, who are capable of sustaining power through established knowledge set by themselves. A point to be made here is that there are levels to this disparity. Clearly there are socioeconomic and cultural factors that separate certain people from taking any part in decision-making processes or negotiations between HP companies and local communities, thus, amounting to noticeable obstacles for these unprivileged people. Cast and ethnicity are usually intertwined in Nepal, and for an individual to be identified in the lower part of that spectrum results in a low social status. Furthermore, women are traditionally burdened with a lower status than men and are therefore usually

excluded from decision-making processes. This claim was confirmed by our observations when visiting the villages surrounding LIHPP, IHPP, and AHPP as mostly men were present in the villages while the women were working in the fields. NHPC did not seek to remedy such disparity in their EIA report. Instead, they merely states that “women in the project area, as other parts of the country, are regarded as second degree citizens. They do all household chores including cooking, looking after the children, tending cattle, and even work in the field” (NHPC, 2002b, pp. 33-34). NHPC asserts that the inclusion of both sexes in decision making processes is not only a challenge to HP development in rural areas of Nepal but a national one that is deeply embedded in many Nepalis self-understanding. Accessibility to knowledge, and especially that which is first-hand, is a sign of an actor assuming a privileged position in the network by undergoing the necessary steps in the translation process in order to create the alliances required to become a macro-actor.

After knowledge is disseminated, whether that information is given directly or indirectly, more expectations are bound to arise. The obvious concern to be mentioned, in the context of this chapter, was voiced by a local woman in the area of LIHPP. She expressed a desire for more participation in hearings and meetings between locals and HP companies as well as stating that she “(...) wants more than second hand knowledge on HP and their [NHPC’s] projects.” (The Concerned Public 2018, IHPP/LIHPP Interview, 25-26 February). The experience of HP development gives a practical insight for the public to understand and which expectations that should follow. Demands are therefore difficult to voice if little to no expectations are present, thus, with first-hand experience of HP, the public now has a firm grasp of the potentiality of HP development. Infrastructure, jobs, and consequent accessibility to schools and hospitals have contributed to lifting the livelihood standard, while demands continue to grow along with increasing awareness of HP development. This is, however, a slow process, which is impaired by a knowledge dissemination that is catered by HP companies to village leaders and intellectuals. In turn these leaders and intellectuals merely provide second hand knowledge to the concerned public or those deemed to be (i.e. project-affected-people). The definition of those project-affected-people indicate the presence of macro-actors, since such shows a delineation between who is given a voice and who is silenced. Therefore, it could be said that awareness is given to those with voice and unawareness to the actors being silenced. The village leaders as well as AKWUA reaffirm a position as spokespersons, who also become powerful spokespersons by neglecting concerns held by some other villagers and speaking on their behalf. Furthermore, they are capable of not only black-boxing knowledge in regards to HP development but also silencing other actors of the concerned public. This will ensure their own benefit as disseminated knowledge is transformed into MoFs. Awareness, and essentially unawareness, are ordinarily clear symbols of respectively empowerment and

disempowerment, nevertheless, in an ANT framework it is quite the opposite. In this case unawareness means that the actor is not forced to take into account the viewpoints of other concerned actors. They are able to ignore others, because the interests of those neglected actors have been absent in the translation processes or, at best, have been displaced.

8.5 A Technological Fix

The previous chapter illuminated how public unawareness in regards to HP impacts ironically makes it difficult for the concerned actually to define concerns and consequently also demands. It seems to be common sense that a concern can only exist based on something else, whether it is an actual issue or the prediction of one. In other words, the *matter* has to be the foundation of the *concern* as something comprehensible and perceivable to the subject such as prior experiences with similar matters, an actual physical matter that intervenes with daily lives or the anticipation of one. Based on this realisation, this chapter takes a point of departure in tangible technological matters by analysing the socio-technical dynamics taking place and how they impact the surrounding environment.

8.5.1 Great Ambitions and Broken Promises

In chapter 6.1 we described the two natural factors that most heavily influence the power capacity of a HP plant in terms of the quantity of water and the available head (i.e. the water pressure). As the latter is optimised by lengthening the penstock tunnel, it leaves a section of the river vulnerable to exsiccation, which curtails migratory fish patterns (NHPC, 2002b, p. 57.). Such occurs in particular during dry season due to the hindrance materialised by the dam site (picture 6). The directly affected river stretch was in the case of IHPP 3.5 km long, an important factor that could potentially negatively affect the irrigation of the surrounding farmland. This was not the case as most fields were located at higher altitudes than the river and instead were supplied with irrigation water from tributaries. Several local people did, however, use the river as a way of balancing their diet and increase their income by catching fish. This is something which is also echoed in the EIA report as it was stated that “[t]he income from fish catch is not sufficient for their daily expenses but it helps for better living.” (NHPC, 2002b, p. 30.). The local people, whom we interviewed, did not surprisingly connect the sparse amount of water in the river during dry season with the reduced amount of fish. One informant had observed that “[a]ll the big fish are gone. (...)” and further elaborating on his youth, where he stated: “(...) My dad used to tell me that fish used to be so big that they would occasionally attack people who bathed in the river” (The Concerned Public 2018,

IHPP/LIHPP Interview, 25-26 February). The ambition to fulfil EIA standards and thus to push forward to operationalisation may be too great for insurance of ethical practice.

Picture 6: the nearly dried out Indrawati River on the downstream side of the IHPP dam during dry season.

In the EIA report, NHPC recognises the possible negative effect that the limited discharge of water into the Indrawati River and hindered migration might have despite the fact that they assert that only three out of 20 identified fish species will be affected (mainly due to hindered upstream migration) (NHPC, 2002b, p. 27.). The conclusions in the EIA report corresponds poorly with statements expressed by those of the locals, who actually make use of the river for fishing. Pandey was not a part of the company during the time of conducting the EIA report, but during an interview with him, he expressed concerns regarding the possible lack of accountability by HP companies in the late 1990s: "(...) a lot of people did not have any idea of what should go into an EIA report, because we've never really had those [EIA reports]. So a lot of times companies did it themselves, they hired a few people and said 'let's write a report' and they did it themselves." (Pandey, K. 2018, NHPC interview, 4 March). This is an indication of the ad hoc approach to assessment reports that took place before the turn of the century. Pandey refers to the late 1990s as 'another time', where the construction of HP plants and the generation of electricity was the sole focus of HP projects and not the adverse effects that it inflicts. HP is often only seen through 'one eye' as a technical issue that should be approached with technical solutions, however technology is merely one part of the solution. (Sovacool et al., 2011, p. 3475). Such a criticism is substantiated by the numerous historical cases that show the intertwined nature of science, technology and humans, one of which is found in Latour and Woolgar's now infamous study in the *Laboratory Life*. Here the authors argue that the notion of the protein is human made rather

than the protein being a hidden element of nature, waiting to be discovered (Latour and Woolgar, 1986, pp. 64-65). The story of the protein also serves to illustrate the broadness of what could be embedded in the term, *technology*. In this case, the protein itself is a technology with an intended purpose of bringing us closer to an understanding of nature. The same thing can be said about social practices such as farming and fishing, which from this perspective are technologies that are neglected in the 'one eye' analogy. Implicit to this is the need for a more holistic approach to solutions.

The 2001 Hydropower Development Policy (HDP) states that the amount of water discharge into the river sections downstream of dam sites have to be at least 10 percent or the percentage that is identified as necessary in the relevant EIA report. As this is a policy (and not an act) HP companies are not compelled to comply, nonetheless, it does reflect an environmental concern when HP companies decide to do so. Furthermore, this will most likely pave way for a smoother process of getting IEEs or EIAs approved by the relevant state authorities. This assertion is based on the discovery that all HP developers, included in this investigation, referred to the 10 percent (of water discharge) as an absolute minimum. NHPC has in their EIA of IHPP addressed this issue by affirming that "[i]n order to ensure survival of resident and mid-range migrant fish population, a minimum flow will be required for keeping the pools and nursery beds maintained with fish and other invertebrates. To minimize the dewatering impact, a riparian flow of 10 percent of total flow of dry period is recommended to be released for five months each year (i.e. December to April)" (NHPCb, 2002, p. 93). The fact that all areas suitable for HP development are unique in terms of geography, geology, ecology, river characteristics, and publics arguably affect the percentage of downstream discharge needed at different HP projects in order to "(...) compensate downstream effect during dry season." (NHPCb, 2002, p. VIII). Acharya presented some interesting thoughts to this issue exemplified in another project which he had been taken part in. He explained that it took his team two years of study to establish the percentage of water discharge, whereas he suspects other projects arrive uncontested to the illustrious 10 percent. (Acharya, P. 2018, HCE interview, 23 February).

The critique is particularly interesting, because it is uttered from a member of an HP consultant admitting to the apparent procedure of settling for the lowest customary percentage of downstream discharge. This is a black box, which Acharya suggests that the approving authorities should open up by investigating into how these studies were carried out by HP companies or those hired to conduct the studies. In summary, there are two aspects to the issue. One revolves around the assessments of the actual required downstream flow. Another throws suspicion on whether the 10 percent is purely a number written in EIAs and IEEs to satisfy state authorities, which is not followed through in practice. Care employee, Gautam recognised this issue: "We are lobbying the government agencies and HP

companies to release a certain amount of water into the stream (...) I believe it's 10 percent of the water. In reality this is not happening." (Gautam, D. R. 2018, Care interview, 14 March).

The dam sites at RoR scheme HP projects constitute the primary technological matter, which might be reconfigured by the will of macro-actors in order to regulate downstream impacts. Yet, at the expense of reduced HP generation. Some of these impacts are complex in the sense that the consequences in some cases are not observable until some time after HP generation has commenced. Similar to the issue of the 10 percent downstream discharge is the matter of the fish ladder technology. Fish ladders were mentioned by several NHPC staff members at the IHPP as the preferred solution to ensure free migratory passage of aquatic life. This constitutes a mitigation measure, which is an option mentioned in the NEIAG and also described by NHPC as a necessity "(...) because the weir site is located at the main range of Asla [Snow Trout]" (NHPC, 2002b, p. Vlll) which has been identified as one of three affected migratory fish species (Ibid.). However, as picture 6 shows, such an option only makes sense if there is water for the fish to swim in. The similarity between the issue of fish ladders and the issue of the 10 percent downstream discharge lie in the somewhat black boxed notion that meeting these recommendations equals the sentiment of being a responsible HP developer. This was echoed at AHPP, where the station manager and operator staff ensured us that the fish ladder was working fine during the monsoon season. Meanwhile, they devalued its importance during dry season with reference to all the fish they had observed climbing the ladder in periods with an abundance of water. Even if downstream water quantity is adequate for fish to migrate there are many considerations to take into account in terms of fish ladder design. Every river system is dynamic and has unique characteristics. For a fish ladder to be 'fish friendly' depends on factors such as the accommodation of the rheophilic[6] behaviour with the migratory fish (Agostinho et al., 2011, pp. 6-7), lighting conditions, water temperature in the ladder, and adequate maintenance of the fish ladder (Office of Technology Assessment, 1995, p. 66).

We have so far argued how mechanisms for ensuring fish migration in river streams may be perceived as technologically and regulatory black boxed actors, who maintain such positions due to the will of powerful actors within the HP networks. This is not an easy issue to combat for the villagers, who are directly affected by the consequences of limited downstream water flow, as impacts may still occur even if HP companies are meeting the rules and regulation surrounding the 10 percent discharge. Gautam asserts that HP companies are only meeting these requirements on paper in EIAs and IEEs and not in

[6] the preference of living in flowing water

practice. This is, however, not a statement we can confirm from our visits at AHPP and IHPP. However, there does seem to be inherent issues to the legislative framework on this matter.

8.5.2 Toward a Socio-Technical Model for Public Engagement

Technology is dynamic and configurable by human and non-human actors who engage with it. Whether that is NGOs advocating for HP companies to apply greater degree of public engagement during the different phases of HP development or something as tangible and material as regulating the downstream water flow of the river through dam technology. This configuration or reconfiguration of the materiality of HP technology may be exemplified by a challenge, which has to be addressed in all HP projects, which is the issues connected to sedimentation build-up.

All RoR scheme HP plants have a sedimentation basin that removes unwanted sedimentation for ensuring 'clean water' for the turbines at the powerhouse. At IHPP a new sophisticated de-sedimentation system was installed, which according to operators at the site, has proven very effective. In time, this might reduce the time spent removing sediments during dry season where the basin is usually emptied for water for a period of approximately eight hours one time pre-monsoon and one time post-monsoon. Thereby, halting power production. This is a 'fix' which, according to one of the station manager, will become a permanent solution to the issue if it continues to perform as good as it currently does. In other words, it has the potential of being a solution to a technical issue. This is, however, an issue which mainly actors in the HP network that benefit financially from continues HP production have a strong interest in pursuing. The halted HP production results in a power cut, for those locals to the HP plant, since local villages are connected to the local grid and not the national grid. Despite the mutual interest in electricity by all actors, it is for different reasons and consequently they do not share the same concerns. An MoC, thus still exists after the installation of a well-functioning de-sedimentation system, which to some extent resembles the 'one eye' analogy from earlier.

Gautam describes an alternative approach which was applied in Care's Hariyo Ban Project in the Western region of Nepal where several HP plants are located along the Marshyangdi River. In this area Care implemented the PES concept (Payment for Ecosystem Services), which refers to a scenario where "a beneficiary or user of an ecosystem service makes a direct or indirect payment to the provider of that service." (UNDP, 2018). In this case, the beneficiary/user is the HP companies and the provider is the local communities along with its peoples. PES was operationalised by establishing a civil

committee across 22 VDCs in the area. Members of each VDC participated in two community level consultancy workshops and one district level workshop. In these workshops a number of ecosystem services were identified and prioritised according to their level of importance to the communities. 'Clean water' for HP production was identified as one of the top priorities (Gautam, D. R. 2018, Care interview, 14 March). Subsequently, Care facilitated meetings between the civil committee and the HP companies where the parties can "(...)present their issues: so their limitations, their oppositions, their challenges, and new ideas. This is the interface where they [the local people] can influence the HP companies and thus benefit the local communities". (Ibid.). During these meetings, agreements were reached that resulted in a contract where HP companies pay local people to do forestry work along the river bank with the help of expertise provided by Care. Thus, reducing the amount of sedimentation built-up in the sedimentation basins by enhancing the 'water quality' in the river. Such sedimentation built-up that the HP company otherwise had to spend money on removing themselves. Accordingly, this initiative benefited the HP company as well as the local communities.

In comparison to the solution opted for by NHPC at IHPP, a larger group of actors are mobilised around a common goal to which they are all accountable and thus have a stake. More than moving into the role as a facilitator, Care becomes the spokesperson that direct these actors through an OPP revolving around the sedimentation issue by presenting the PES scheme, to which HP companies and the concerned public share an economic interest. Altogether this frames the PES as a highly socio-technical concept. In addition to this, the continuous preservation of the natural environment benefits the ecosystem which constitute the third actor in this translation process. Altogether this initiative takes into account all the aspects affiliated with term, *environment*, as defined in the EPA: "(...) interaction and inter-relationship among the components of natural, cultural and social systems, economic and human activities and their components." (Department of Electricity Development, 1997, p. 1). Care is prone to be framed as an actor with stronger ties to the local communities than to the HP companies, since Care's primary aim in the Hariyo Ban Project is "[t]o reduce adverse impacts of climate change and threats to biodiversity." (Carenepal.org, 2018). Such is the case, since local communities have strong interest in preserving the ecosystem as it, for the majority of people living in rural areas, constitutes the foundation of their livelihoods (Sovacool et al., 2011, p. 3469). Care may be characterised as a spokesperson speaking on behalf of the local communities during the translation process. The process is, however, fragile in two ways. Either the negotiations collapse or agreements are achieved, but at the expense of displacing the original concerns. In the latter scenario, the stability of this newly formed network will be contested over time if interests and concerns are altered to a degree where the concerned public no longer recognises them. To ensure continual stability, Care

has to demonstrate great cautiousness especially toward the concerned public who arguably have the greatest stake in the matter as the MoC surrounds their homes.

We have argued how HP companies as actors interpret legislative guidelines in ways that to some extent have black boxed HP technologies as eco-friendly and responsible initiatives. Consequently, HP production can be increased in the dry season where water flow in rivers is sparse and HP plants often run on one-third of total generating capacity. This occurs at the expense of the ecosystem and the majority of the local people who lives off of it.

Lastly, two methods for preventing sedimentation built-up has been compared. One relies entirely on sedimentation removal technology, while the other is making use of a combination of aforementioned and forestry work carried out along river banks by local people. Both methods have to our knowledge proved effective, however, the latter possess greater intrinsic capabilities of bringing actors together and thus strengthening the HP network. This example may inspire HP companies to engage local communities in socio-technical solutions to other challenges connected to HP production.

8.6 From Preparation to Post Construction Monitoring

The outset of most commercialised HP projects in Nepal is either an IEE report or an EIA report. The IEEs require less time and resources to conduct compared to the EIAs, which on the other hand, depending on the complexity and magnitude of the construction work, can constitute "(...) a long and tedious process, sometimes more complicated than building the dam itself." (Sovacool et al., 2011, p. 3472). The reports include a chapter that address' "(...) matters concerning environmental management plans (EMP)." (Ministry of Forests and Environment, 1997, p. 51). It is somewhat unclear as to what this entails, which is also noted in the EIA for IHPP: "The requirement of EMP for project implementation in Nepal is vague" (NHPC, 2002b, p. 104). Nevertheless, these plans are to be implemented by the HP company and monitored by a government agency. As this chapter will show, both implementation and monitoring are often subject to misconduct or negligence by both government agencies as well as HP companies. The process of conducting assessment reports, implementing EMPs, and to continually monitor and evaluate the agreed-upon EMP is a task, which require actors on both sides to take responsibility in order to be successful.

8.6.1. Assessment Reports - The Issues of Independency and Non-Independency

Munch-Petersen has already touched upon the subject and issues associated with the fact that no legislative document explicitly describes any requirements on the role of the accredited assessor (Munch-Petersen, 2017, p. 10). Thereby, HP companies are allowed to conduct IEEs and EIAs non-independently. He recommends a "(...) licensing system for accredited independent EIA organizations (...)" (Ibid., p. 19). The idea of having independent assessment organisations appear as a logical, if not obvious, policy in order to acquire trustworthy EIAs and IEEs. Such a change is, according to Pandey, affiliated with certain structural challenges, which he believes will cause more harm than good across the spectrum of actors in the HP network. Pandey asserts that RoR scheme HP projects cause little harm to the natural environment and as a result the assessment focus has changed.

> "(...) the environmental studies are not so much keen on the flora or the fauna. They are more people centered; how many people are losing jobs, how many people are losing homes and land (...), because in the mid hills of Nepal there isn't that much 'environmental stuff', the 'soft' environment, besides the people. (...) So my understanding - and it is based on experience, not research - is that these hydropower projects don't have that much impact on the natural environment. But they do have impact on the people living around it, so that is what we should look at. As developers we are actually better at dealing with those, than the government is, because if we need some land, we compensate the people for what they want and then they are gone. On the other hand, the government has many more regulations to go through and especially if they have large projects then the donor agencies have a lot more say; so the world bank or the IMF [International Monetary Fund] or the European bank. They have much more power. So the private sector can manage that quite easily. Much more easily than the other players." (Pandey, K. 2018, NHPC interview, 4 March).

Pandey may be right when he asserts that assessment reports have a predominant focus on people rather than natural environments. However, such a sharp delineation ignores the intertwined relationship between the two actors as the concerned public often depend on natural resources for sustaining their livelihoods as already touched upon in chapter 8.5. Nonetheless, if the focus has changed, it is fair to assume that it has disseminated top down from government authorities as they are the policy makers. Thus, are the dictators of what should go into the reports. Another interesting point from the above quote revolves around the complications connected to conducting assessments reports and applying measures of mitigation through government agencies. The multiple actors engaged with NEA in HP projects are not as easily aligned in a network compared to those engaged with private HP

companies in comparable HP projects (in terms of HP capacity). This is, as Pandey points out, due to stricter regulation and additional bureaucratic gatekeepers to pass. This type of bureaucracy can be perceived as a security measure, which demands NEA to consider a wider array of public concerns in that the NEA as a public institution represents the public. In turn, it may be more time-consuming to negotiate issues, impacts, and mitigation, but arguably also a more democratic process as actors keep one another in check. This is, however, highly speculative in that the NEA in general is not considered a reliable institution as will be unfolded in regards to monitorisation later in this chapter. According to Pandey, EIAs take almost three years to complete and private HP companies are currently given a five years' survey license for such studies (Doed.gov.np, 2018c). This, Pandey claims, is already a great challenge as there is only a limited time frame for the remaining studies to be completed. Handing over this responsibility to government syndicated agencies would according to Pandey, firstly, prolong the time it takes to complete an EIA or IEE study and, secondly, make HP development increasingly expensive as he anticipates that only five or six agencies would then be accredited to carry out these tasks. In such a way relishing from having a monopoly-like position. Furthermore, Pandey asserts that when HP companies carry out assessment studies themselves, there are indeed "(...) checks and balances along the way (...)" (Pandey, K. 2018, NHPC interview, 4 March) in the form of various ministerial departments that are responsible for approving the components of the reports. This is a form of regulation, although Pandey admits that the government still struggle to detach the components of the non-independent reports from the HP developers who write them (Ibid.). Pandey's statements are somewhat ambiguous as he, to some extent, recognises the downsides of non-independent assessments reports, while he at the same time highlights the private sectors 'inherent' capabilities of quickly managing issues related to compensation measures. Such actions takes much longer time in the public sector due to the inert bureaucracy. There are obvious advantages and disadvantages to the current regulations that apply to the private as well as public sector. NEA is the promoter of 17 HP projects corresponding to 51 percent of Nepal's total HP capacity (Doed.gov.np, 2018a; Doed.gov.np, 2018b) and although the 1990 political change paved way for private investors, it is noticeable that the HP capacity share between the public and private sector has almost equalised. Such is an indication of the speed in which private companies have established themselves in the HP sector and a result of easier compliance with regulatory framework. For private HP companies, this entails that the construction of HP plants in general take less time compared to those constructed by the NEA and in turn they are quicker at becoming economically sustainable. However, as the regulatory framework is less constraining for private investors, they may also be more prone to ignore concerns belonging to a concerned public.

Acharya proposes what resembles a compromise, a simpler approach in which "(...) whoever has prepared the study and the *terms of reference* (ToR) should not be pursuing an EIA (...) [a]t least this would ensure some kind of independency." (Acharya, P. 2018, HCE interview, 23 February). Implicit to this remark is the recognition that it is not a lasting solution, though a step in the right direction. The legislative framework for conducting proper independent EIAs and IEEs seem ill-suited to cooperate with independent assessment reports. In this regard, the current legislation can figuratively speaking be described as a somewhat 'obstructed' and 'concealed' OPP for independent assessment reports to pass through. The OPP is concealed for the HP companies in regards to the EMP criteria, while obstruction should be understood in the five year survey license that Pandey asserts to be difficult not to exceed.

8.6.2 Sustainability through Investors

Most HP projects in Nepal are funded by outside investors either in the form of donor contributions, which was the case when the United Mission to Nepal gave funding to the construction of AHPP. In the words of Pradhan, this is because "[h]ydropower is not like other industries where you can get returns [return on investment] very quickly. It's a longer gestation period. (...) the local lenders are still not geared up to that extent for investments in hydropower." (Pradhan, P. M. S. 2018, BPC interview, 26 April). HP companies are thus inclined to approach outside investors, often big organisations like The World Bank, The European Bank, or The International Monetary Fund. For investors there is an expectancy that the HP projects to which they donate or lend funds, will become financially sustainable within a period of time. Investors have in recent years presented HP companies with demands linked to sustainability. More concretely these demands are in the form of HP guidelines such as IHA's *Hydropower Sustainability Assessment Protocol* (2010), which is conceived with similar intentions as Nepal's very own NEIAG. Not only does the HP company need approval of EIAs or IEEs from government authorities prior to any construction work, they also need approval from investors in order to access funds necessary for HP projects to materialise. Investors are not new actors to the HP network in Nepal, but contrary to the 1990s, there is a much greater focus on environmental impacts and as a result these actors have shifted position within the network. Investors have become much more concerned about the public profile of their organisations. Similar to many other industries, where the notion of corporate social responsibility (CSR) has manifested itself perhaps spurred by the increasing academic interest in the subject. The Kabeli HP Project, mentioned by Acharya, is a good example of that as The World Bank required an EIA along with full disclosure of documents

before they would fund the project, although, the project only qualified for an IEE according to Nepali legislation. One may say that sustainability, as a MoC, has changed the dynamics of the HP network and consequently HP developers have to work harder to mobilise and align the interests of actors in the translation process in order to stabilise the network. This is arguably an improvement from a sustainability perspective in that HP companies are forced to be much more environmentally accountable throughout all phases of HP development.

As with all other regulations and guidelines some actors will try to find a loophole to exploit in order to achieve an objective at a faster pace or by reducing expenditures. This statement might be somewhat simplified or even polemic. Yet, Timilsina points out that even the HP companies ensuring public participation will at some point issue public shares and by doing so they risk "(...) damaging their own dream, because shareholders have their own dreams as they invest and they care mostly about profitable returns." (Timilsina, N. 2018, NHPC interview, 14 March). Hence, there is an inherent risk that the return on investment becomes the predominant interest of HP companies although it to a greater extent is being challenged by a greater focus on CSR. The loophole that we are referring to revolves around what has just been mentioned; the fact that HP companies have to be much more accountable throughout the phases of a HP project, but what happens if someone starts to scratch the surface.

> "(...) if you want to secure funding from international funding institutions and have done this IHA assessment protocol and received a good score during pre-construction, then it is easier to receive funding. But what if all is agreed upon during pre-construction and the funding is given but then during construction all is forgotten. Nothing is followed up thereafter. So who is going to tackle this?" (Acharya, P. 2018, HCE interview, 23 February)

Acharya asked this question during a recent workshop with HP consultants and developers. This is, so to speak, the elephant in the room, and the reason why Acharya also characterise this question as a controversial one. However, the question might not be so difficult to answer. The solution appears to be proper post-construction monitorisation, however it is doubtful whether participants of the workshop were willing to solve this problem.

8.6.3 Monitorisation of Hydropower Projects

We have touched upon the issues directly connected to the pre-construction phase of HP projects. These are serious matters, however, they still constitute matters connected to how HP projects are made possible through funding and acquisition of necessary licenses. Most

issues, which may cause negative environmental impacts do not materialise until the construction phase is commenced.

> “HP companies conduct the EIAs and the IEEs, but the main effort is put into writing the reports. The actual assessment, on the other hand, they don't care about that. They don't implement the plans from the reports [the EMP] and nobody monitors properly.” (Gautam, D. R. 2018, Care interview, 14 March)

As a Care representative, Gautam’s view on HP development does to some extent oppose that of HP developers. Hence, one might assume that such a critique would be discarded by HP companies when delivered by an NGO. Gautam’s critique is aimed at HP companies for their lack of implementing EMPs and the government agencies for their lack of monitoring (which according to the EPR is a government responsibility) this claim was confirmed by Acharya who as a consultant has been working with BPC multiple times. Acharya points at the broken link between assessment reports and subsequent monitoring. He asserts that if HP developers met only half their commitments in practice and if the government were to only do a bare minimum of monitoring then the current situation would still improve significantly (Acharya, P. 2018, HCE interview, 23 February).

In this context Assessment reports remain a glossy surface that might attract investors, because of the apparent environmental concerns that they have to take into account. However, if government authorities do not live up to their end of the bargain, then who ensures a development process where this is fulfilled in practice during the phases of construction and operation? This is an issue that cannot be remedied through legislation that dictates new regulatory demands for assessment reports as government authorities carry the responsibility for monitoring. Omitting their own role, as gatekeepers for HP companies, hinders progress toward greater sustainability. As an actor the government has a strong position in the negotiation process, where they are supposed to negotiate on behalf of the concerned public. The government does not fully represent its people, rather they are influenced by powerful interest groups. As a result, they may prioritise one concern over another, and, thereby, opting for a potentially unpopular decision, but perhaps one that is believed to be more beneficial for Nepal in the long run? Pandey insinuates exactly that and also that government incentives are based on something else: “Well, they [the government] say that they don't have the manpower, they don't have the budget, but I think it is just motivation, there is just no motivation for the government to go and do that [monitor HP projects].” (Pandey, K. 2018, NHPC interview, 4 March). Perhaps government motivation is deprioritising concerns connected to the environment, thereby considering those less important. As Munch-Petersen points out, the scale and significance of environmental impacts are often subtle and/or manifests themselves slowly (Munch-Petersen, 2017, p. 7).

This sometime slow and subtle manifestation may push such concerns aside for something else. Pradhan is very explicit when he describes what that 'something else' could be:

> "I don't see any monitoring from the government side for the projects we have. (...). I don't know how they do the monitoring, but properly as long as the power plant is generating and providing electricity, as per the contract agreement [with the NEA], they properly think: "Ok, they are doing fine". That's maybe one way of monitoring as well [laughs]. (Pradhan, P. M. S. 2018, BPC interview, 26 April).

The tragicomic irony of this comment is not easily ignored, but more interestingly it displays something else; BPC as well as NHPC perceives this to be a serious issue, Pandey even describes it as "(...) the most lacking part of this whole environment thing". (Pandey, K. 2018, NHPC interview, 4 March). It is interesting since the lack of monitoring actually benefit HP companies from a financial perspective, so what interest do HP companies have in criticising the government? The issue appears ambiguous because, as touched upon in the previous section, some HP companies seek to exploit the loopholes in order to acquire approval for HP projects in terms of funding and licensing. In order to further unfold this point we may once again benefit from drawing on the issue of the 10 percent downstream discharge. In an effort to secure profit from HP, HP developers are willing to lie on the EMP in regards to future commitments. Acharya asserts that such a scenario is largely due to an absence of monitorisation (Acharya, P. 2018, HCE interview, 23 February). Such a statement is based on his experience as a consultant in the formulation of multiple EIAs and IEEs for HP companies. The obvious reason as to why many HP companies do not commit to this in practice is that water is a sparse resource during dry season. To meet this commitment, thus, means generating less HP and subsequently less electricity is available to sell to the NEA. Acharya claims that BPC do in fact fulfil this commitment in their HP projects, but doing so may result in another type of financial consequence which the following example proves to show.

HP companies sign a *Power Purchase Agreement* (PPA) with the NEA, that, among other things, state how much electricity the HP company should sell to the NEA through the months of the year. If an HP company cannot fulfil this commitment, then it follows that the NEA will issue an economic penalty. BPC experienced this a number of years back, during an unusually heavy drought in most of the country. As a result of the drought the Jhimruk HP project in the Pyuthan district could not generate the necessary amount of electricity to meet the agreement stated in the PPA. According to Pradhan, BPC tried to avert the fine by referring to the exceptionally low rainfall that year, which NEA was willing to accept as an excuse on the condition that BPC could provide evidence from the chief district officer of Pyuthan. The district officer was reluctant to provide such evidence officially, although The

Department of Hydrology and Meteorology had records showing how exceptionally dry that particular year was. Thus, BPC ended up paying the fine. Pradhan told the story to emphasise what kind of monitoring NEA is actually doing and what their main concern is. Yet, this is an example of how an overemphasis on HP power construction may punish HP companies for actually discharging the 10 percent of water downstream. Such a penalty removes the incentive for HP to 'do the right thing'. This might explain the ambiguous attitude expressed by Pandey and Pradhan. HP companies surely bear the main responsibility of meeting their commitments in EMPs, but to perceive them as 'evil capitalists', who will push all other concerns aside for financial gain is also a too simplified explanation of the current situation. Rather, HP companies are operating within a system that is not equipped to support sustainable HP development nor is there a prevalent government interest to facilitate change. Within the HP network, the government is to a great extent negotiating through the NEA in a way which echoes Callon's concise definition of a translation process: "To translate is to displace" (Callon, 1986, p. 18). In this case, the displacement is seen in the way that HP companies act. Furthermore, it explains why they act as they do. The displacement assures that HP developers, as a single actor, is aligned with the central concern of the government as stated in the 2006, Rural Energy Policy: "(...) to contribute to rural poverty reduction and environmental conservation by ensuring access to clean, reliable and appropriate energy in the rural areas." (Ministry of Environment, 2006, p. 2). This was echoed recently by the Minister for Energy, Water Resources and Irrigation, who stated that "We have set a goal to generate over 10,000 megawatt of electricity within the next 10 years." (Kathmandupost.ekantipur.com, 2018). Perhaps too much emphasis is put on 'electrifying the nation', thus building a deterministic and almost unshakeable faith on the increasing and measurable number of MW as an answer to whatever challenges exist in rural Nepal. Such amounts to a clear MoC held by the concerned public, who need both water and electricity for sustaining their livelihoods.

The government is, as stated several times already, responsible for monitoring HP projects, but as we have argued, there is a lack of motivation from their side to do so. Undeniable, it is difficult to change the will of the government, because of the authoritative position they possess. The government has become a macro-actor actor even before engaging in the HP network, due to the fact that they are supported by the will of the Nepali people when it came into office. They were thus given authority and although the government has been given formal power until the end of the term, their position as a macro-actor, may diminish if they lose the support of the people.

8.7 Good Intentions, Bad Outcomes: the Story of Unanticipated Results

Thus far, this analysis has demonstrated how HP projects often do not operate in accord with EIA or IEE reports. Changes in local livelihoods, political rationales, and stakeholders of HP projects can all contribute to an imbalance, which may potentially derail the aim of well-intended legislations. Such a sentiment is echoed by Pandey, who claims that recent Nepali history has greatly affected the mind-set of its people. The political instability and recent earthquake "(...) proceeded with 10 years of uncertainty with many changes in government, resulting in constant confusion as to who your government really is. All of that somehow reflects on the communities that we are working with. (...) So all those things make the social issues very dynamic and very challenging." (Pandey, K. 2018, NHPC interview, 4 March).

It is clear that the challenges faced in HP are manifold and indeed intertwined. The governmental promise of lifting the Nepali people out of the darkness and into a brighter future through hydropower development entails many good intentions that sometimes brings unintended results. This chapter will unravel the multiple dimensions of well-intended legislations and other promises, which often produce unanticipated results that have negative consequences.

8.7.1 The Consequences of a Monopolised Electricity Distribution

As mentioned previously, IPPAN was created to help ease the way for the private sector to enter the HP market, and from there contribute to the process of bringing prosperity to Nepal. This access was however conditioned by the fact that all future PPAs had to be negotiated through the NEA, which in turn gave them exclusive rights to sell electricity nationally as well as internationally (Butler & Rest, 2017, p. 18; Munch-Petersen, 2017, p. 9). Consequently, this paved the way for a monopolisation of electricity distribution. On the other hand, the decision from the Nepali government in the past to open up the floodgates for private investors created a competitive market with public and private HP companies. Within this contentious field, it is notable that private actors would battle over another kind of power than the one belonging to hydro.

The introduction of private actors into the HP market brought along an ambition amongst HP companies (especially private ones) to emulate business strategies from outside the HP sector. This occurred as "(...) hydro professionals have battled vociferously for a business milieu with qualities common to private sectors in nations around the world: low regulation, investment-friendly tax rates, and expedited processes for socio-environmental approval of projects (Butler & Rest, 2017, p. 16). Therefore, similar to a

competitive market, the HP landscape became occupied with more producers seeking to meet the growing demand of stable electricity from the Nepali population. Nevertheless, unlike a competitive market, the HP field includes a single distributor (i.e. the NEA) dictating the market. Thus, a strange middle ground has been achieved that is neither a pure competitive market nor is it entirely the publically run HP market prior to 1990. Despite the HP landscape not taking a form that may be healthy for either the private or the public sector, the HP sector has reached a format that can sustain operationalisation. The existence of public-private partnerships, such as BPC, presented new opportunities that could break barriers that haunted the private and public sector respectively. By BPC moving from being completely government asset to becoming mostly privatised through a competitive bidding in 2003, wherein the majority was bought by Shangrila Energy while a minority were purchased by the NEA, meant that the company could envision further into the future without fears of government or political instability (Acharya, P. 2018, HCE interview, 23 February). The link to NEA was never disconnected as they remain the sole distributor of electricity in Nepal. The NEA is described amongst public discourse and informally, during our interviews, as an unreliable institution of the government, which says a lot for a country like Nepal with an abundance of poorly managed government offices (Dhakal, K., 2018, Ward Interview, 8 March). NEA assumes the role as a macro-actor, who dictates the mechanisms of the HP network. This is the result since NEA has successfully translated the will of other actors, i.e. HP developers, thereby allowing this macro-actor to transform a multitude of wills and concerns into a single one. Meanwhile, the political initiatives to encourage private investment through the 1990s until present day sheds more visibility to private HP actors and thereby give them a louder voice. This enrolment of actors that allow the NEA to assume the role as a macro-actor is arguably forced upon HP companies, since this government agency has monopoly on power distribution in Nepal as a result of government law.

8.7.2 Opportunism and Personal Gain

Ordinarily, NGOs have an important role in many sectors in Nepal (e.g. health sectors, development sector etc.) as a supposed impartial mediator between government and the public. According to our sources, government operations often operate under little supervision and the presence of an NGO usually implies foreign interference in a governmental arena that usually operates through opportunism and corruption (Dhakal, K., 2018, Ward Interview, 8 March; Gautam, D. R., 2018, Care Interview, 14 March). Gautam states that engagement with the private sector is, not surprisingly, a more favourable avenue than the public one (Gautam, D. R. 2018, Care Interview, 14 March). However, it may seem

that more public concerns are addressed in HP projects where the NEA is shareholder (such as with AHPP) as government representatives are held accountable. This is an interesting paradox between private and public sector. Moreover, the licences attached to the initial stages of planning an HP project has proven to serve as a market for individual gain. Timilsina, claims that many private investors will commence a preliminary survey and thereafter acquire a license which they will keep onto until they can sell it on for a large profit (Timilsina, N. 2018, NHPC interview, 14 March). Thus, allowing the private sector into the HP landscape has introduced an opportunistic market wherein the public sector surprisingly appears to be the beacon of light. Despite the well-intended idea to invite the private sector into the HP market, it seems that it has brought a lot of unwanted characteristics of the private sector along with it.

The shift from exclusive public investing in HP to introducing the private market has arguably marked the proliferation of opportunism on a larger scale than before. The mitigation of opportunism should not be the private developer's burden either. As presented in the previous chapter, proper monitoring could be the answer to combat such obstacles. Nevertheless, a gap exists within HP development, where uncertainty about environmental issues can be refuted or heightened for political gain. Legal grey zones allow HP developers to elevate their own position in the HP network and thereby transform themselves to becoming a macro-actor. Similar to the NEA, HP developers need to problematise the issues in HP in order to ensure enrolment and finally mobilise the will of many through their own actions. Power relations and translation processes reveal the reasons as to how these HP developers transform into macro-actors. As mentioned earlier, it is not stated in any provision, policy or legislation as to who should conduct and formulate EIA or IEE reports. This loophole allows the investors to acquire licenses relatively easy and use those permits as they please. Whether they choose to sell the permits on, hold onto them or pursue the construction themselves, all contribute those private investors to become more powerful actors in the HP network as their visibility and voice both are significantly amplified. Such framework, in combination with the power structures in villages and VDCs, equal fertile ground for more individual gain as opposed to fulfilling the HP dream of enriching the general public of Nepal. This sentiment was strengthened during our interview with Timilsina, when touching upon the idea that sometimes hydropower companies make use of independent consultancy agencies to formulate the scoping phase and/or ToR, but more often than not they do in fact use their own employees. Timilsina shed light on the reality in which the engineer never goes on site but instead operates remotely without ever acquiring empirical knowledge (Timilsina, N. 2018, NHPC interview, 14 March). Access to a potential HP site is, therefore, achieved from a far through a local of that area, which usually is the leader of the village. Due to the highly hierarchical structure of Nepali society, which is often emphasised

in rural areas, HP companies are able to acquire permits for HP projects without having to spend time on-site by mobilising the appropriate VDC or village leaders. Thereby, this procedure, does not only feed into the already powerful position of private investors interested in good practice. It also allows village and VDC leaders to become more powerful spokespersons who either inadvertently or purposely silence other less powerful villagers. Such a practice, in addition to the scoping phase, has the potential of having multiple MoCs heard as these leaders are supposed to represent the villages. Nevertheless, these good intentions are seemingly wasted on opportunism once again. Such is clear indication of the presence of a spokesperson, who through negotiations, has assumed the role as a voice on behalf of others. The villagers have given these leaders the power to speak in favour of them, since these leaders have convinced villagers that they would present their concerns during negotiations with HP companies. Gautam further broadened this perspective by commenting on the role that HP companies sometimes take upon themselves:

> "My experience tells me that in the beginning when I approached the HP companies, whether that being private or government owned, they were not happy with me. These people are coming [HP developers] are making propaganda in the name of the people from the communities." (Gautam, D. R. 2018, Care interview, 14 March).

Short term individual gain is preferred over that which can benefit on a larger scale. These village leaders might be seen as opportunistic spokespersons, who for a moment forget or choose to forget their responsibility of presenting the concerns of their constituents.

8.7.3 Government Initiative for Empowering a Concerned Public

We will now turn to the rather unique association of AKWUA, which operate in the AHPP area. This association aims to facilitate strong public participation, while also assuming the role as a spokesperson for the local communities. Informants at nearby villages of AHPP told us that after HP operation and AKWUA establishment "(...) irrigation has resulted in improvement in production, roads and jobs. For instance, potato crops were only for consumption before, but now it's also for distribution. All that was ensured by AKWUA negotiations, while another informant stated that "the value of land has increased [since HP development]. HP has made the land more attractive and AKWUA helped us buy the land for a cheaper price." (The Concerned Public 2018, AHPP Interview, 16 March). AKWUAs responsibility for land and water distribution should be understood in the context of prior to its existence, a staggering 78 percent of lower caste people of the area owned un-irrigated land

and comparably higher castes only suffered from 9 percent of them having land with no irrigation (Ibid.). As a response to this AKWUA, purchased land from local land owners. Sometimes in exchange for 'water stocks', which gave the locals them more access to irrigation. Afterwards, AKWUA would sell land to low caste poorer farmers to a reasonable price (Ibid.). During an interview with two board members and the president of AKWUA, they explained that AKWUA took initiative to create policies for socioeconomic growth where the government and VDC failed. Furthermore, they insisted that due to AKWUA becoming involved with the operations of BPC in ensuring land and water rights, "[p]roduction and sales of foods has empowered locals. Also land prices went up because of HP development, which has also empowered people around here." (Ibid.). As these statements from AKWUA members indicate, we had a strong impression that they believed that local and national legislation and policies had neglected them. Thus, took it upon themselves to take responsibility for ensuring local prosperity. The mentality behind making such a decision was described by Dhakal, who believed that it is based on the realisation that there is "[n]o trust in the government (...)", partially due to "(...) a lack of communication between national government and provincial, district, and ward governments." (Dhakal, K. 2018, Ward interview, 8 March). Therefore, AKWUA and its cooperation with BPC can be seen as an alternative perhaps expected government intervention for irrigation systems. Despite this attempt to avoid or maybe compensate government legislative mediation, a report from IWMI was published in 2002 concerning land and water rights at AHPP (van Etten, van Koppen & Pun, 2002). Here it is stated that in the promise to focus on the disenfranchised "(...) there is little or no empirical evidence to show whether this option of allocating equal water rights does actually benefit the poor." (van Etten, van Koppen & Pun, 2002, p. 1). The objective to reduce the poverty amongst the lower layers of the community as well as ensuring strong public participation through a water usage association (i.e. AKWUA) seems to be another legislative promise with good intentions, which simply cannot deliver and results in unintended outcomes. The distribution of water and land is in fact disproportionate, since HP development pushed the land prices up and AKWUA was successful in lowering prices enough for the budget of most farmers in the area (van Etten, van Koppen & Pun, 2002, p. 18). The water distribution is disproportionate because smaller plots of land owned by poor farmers proportionally receives less water than bigger plots of land owned by more well-off farmers (van Etten, van Koppen & Pun, 2002, p. 19). AKWUA along with government policies and legislation often have good intention that seem not be able to deliver to its promises.

Legislation sometimes disrupt a smooth planning and construction process of HP project. This seems to be the predominant issue with well-intended legislatives, policies and other HP frameworks in a landscape that is filled with obstacles for the credible HP

developer. The NEA, certain private investors, legislative loopholes, and even initiatives to voice public concerns through an association run by locals, all amount to obstacles in the way to ensure that legislations and policies have the desired effects. Local and national shifts both have repercussions on each other, while they both are fairly unstable this amounts to an unpredictable foundation for the formulation of a legal framework surrounding HP development. A setting where the only certainty is that good intentions will have negative unintended consequences, thus, resulting in the general lack of trust in the government as referred to by Dhakal.

This analysis set out to unfold the HP landscape of Nepal and expose the roles and agency of the actors occupying it. We proceeded to unfold the identity of these actors, which revealed each to be more nuanced than expected; a concerned public implies a singular group with common interests and concerns. Instead, a multiplicity of actors exists that each includes their own issues within the HP network. Some of these act as spokespersons with the example of AKWUA speaking on behalf of those locals to AHPP. In the online world, we further revealed the segregation in academia that exists between the spheres of environmental and technical literature. This gap could benefit from an interdisciplinary and socio-technical agenda as this would provide a more holistic perspective on HP, one which address' the multiple viewpoints of an MoC. In connection to this, IPPAN assumes a bridging position between HP companies and government agencies. Such a role allows IPPAN to act as an intermediary in, among other things, advocating a socio-technical agenda.

The EIA and IEE reports amount to an overall framework of the MoCs held by a concerned public. These reports consist of impact assessments and subsequent mitigation plans to which HP companies are presumably committed. Such assessments include overlapping concerns and issues that amount to MoCs, which often cross between social, technical and environmental matters. At the same time, MoFs were brought to light. These black boxed claims and bases of knowledge were discovered when uncovering the distinction between facts stated by HP companies and the realities documented in our case studies. By allowing actors a voice to unfold their position and concerns, this research is able to expose some of the hegemony that clouds the complexity of the HP sector.

9. Discussion

We have introduced the multiplicity of a concerned public, which is disenfranchised in many ways as a result of being of low cast, being female, being poorly educated, as well as living under the poverty line. Consequently, a broad analysis of the HP power networks have been presented in which we have argued why and how the concerned public is disenfranchised. This network has presented us with MoFs, each of which we have fragmented into an MoC. As already indicated such a move has subsequently nuanced the use of the term 'the concerned public', as there is now several 'concerned publics' with sometimes differing perspectives on a single MoC. Throughout this process of deconstructing MoFs, and thereby attaining different viewpoints, we have drawn heavily on Munch-Pedersen. Such was opted for as his work on public participation in HP development in many ways revolves around a similar issue to the one stated in the research question of this thesis. The first part of the discussion will therefore take an outset in three recommendations proposed by Munch-Petersen (2017) that touch upon subjects which have been analysed in the previous chapters. The intention of such a point of departure, is to present how a techno-anthropological approach to the same issues provide another perspective that goes beyond the legislative framework for HP development. In the second part, we will discuss how the notion of MoC along with second-degree objectivity can bring new light on the term 'sustainability'. In the third and final part, we will discuss three concrete MoCs that will amount to the foundation for three new recommendations for a more sustainable HP future.

9.1 Legislative Recommendations and Beyond

Munch-Petersen recommends an "[a]mendment for mandatory public hearing guidelines, forcing proponents to engage in discussions (consultations) with citizens" (Munch-Petersen, 2017, p. 20). We recognise the need for such legislative amendment, but arranging mandatory public hearings is no guarantee for public engagement or at least only engagement with a few. We have problematised the role that village leaders has as spokespersons of a whole community. The issue being that this concerned public holds a multitude of MoCs, since some members of the concerned public, such as women, for cultural reasons are left unheard in decision-making processes due to the patriarchal structure of the Nepali society. Concurrently, other members of the concerned public may find themselves in the same situation as was the case at IHPP when villagers claimed never to have had any information disseminated from village leaders. As a result, they were completely unaware of what HP construction entailed along with any negative short term or

long term impacts it may cause. Mandatory public hearings for HP projects, that are subject to either an IEE or EIA, thus, need an explicit framework for closing any potential loopholes, which might hinder voices to be heard. If this advice is neglected, then such recommended amendment might turn out to be yet another good intention that lacks a positive result. As a supplement to Munch-Petersen's recommendation, we suggest to address the villagers directly that are likely to be in the lower end of the social hierarchy of the communities, i.e. women, illiterate, low caste, and poor. To cater such a service, we recommend engaging NGOs (like Care) due to their extensive experience with concepts such as PES and REFLECT. The latter has not been addressed in this thesis, but similar to PES it is a concept used to empower disenfranchised groups of people. Although far from flawless, associations like AKWUA stands out by being in critical proximity of AHPP and successful in negotiating on behalf of the communities.

Another recommendation by Munch-Petersen is the "[i]ntroduction of a licensing system for certified Nepali EIA practitioners, in order to prevent biased proponents developing EIA processes themselves" (ibid.). Yet again, we recognise the need for such an amendment, we doubt however that it is the right time for Nepal as it will require much more than just licenses. This assessment is based on the fact that government institutions are perceived with a general lack of trust in Nepal and for good reasons. The licensed practitioners would most likely take form of government syndicated agencies under the NEA, which as an institution is characterised by being inert and unreliable. This would then feed into the status quo of the powerful role held by NEA by enlarging its current role as a macro-actor. Such an extension of NEA's power should be understood in terms of enlarging the monopoly of influence beyond their current grip on power distribution. This has been exemplified by the almost total lack of monitorisation on HP projects along with an HP agenda that, to an excessive degree, focus on monetary gain. Furthermore, it could be said that the level of fear or mistrust that Pandey and Dhakal displayed should be taken into account. In the case of Pandey, this involved a hypothetical scenario of government-appointed EIA monitorisation agencies. Meanwhile, the statements of Dhakal resembles a general distrust in the government. Both concerns are caused by indications of opportunistic behaviour and corruption. In other words, it is hard to visualise a path to follow without any deep-seated obstacles along the way when legislative framework is so blatantly ignored.

The third recommendation proposed by Munch-Petersen is an amendment with the objective of "[i]ncreasing the fines for violating EPR and creating citizen awareness of their EIA rights will put pressure on proponents to obey EIA legislations" (ibid.). This recommendation is bipartite, since it includes both the issue of fines as well as the matter of public awareness. In regards to the former, the EPR is a document that not only holds HP companies accountable but also the government itself. It explicitly states that post-

operationalisation monitoring is to be conducted by the concerned government body, which, as already mentioned very rarely takes place. Therefore, an increase in fines may indeed prompt HP companies to comply with the EPR to a greater extent in terms of the scoping phase and perhaps also during the construction phase. However, this is done to the point where HP companies choose to adhere to (or violate) the EMP in the operating phase remains unknown as no monitoring is carried out. As for the second part of the recommendation, we agree that greater awareness should be created. Nevertheless, such a demarcation as to who is affected and who is not will always be debatable. Therefore, it should not be up to HP developers to define a projected-affected-people, since this simultaneously implies that some citizens will be neglected. For this reason, we have explicitly used the term 'the concerned public' throughout this thesis. This allows for a concerned public to define themselves. Although this is an umbrella term for yet other layers of 'concerned publics' with own inherent interests and concerns, it allows for the individual to define oneself. This is an important element to bear in mind prior to creating awareness and in general when establishing public engagement.

Whereas the focal point of Munch-Petersen's study is on legislative regulations, which frame EIA reports, we believe a broader perspective is needed for a general augmentation of current impact assessment guidelines. We will, thus, proceed by more explicitly address the notion of MoCs.

9.2 Substituting Matters of Fact with Matters of Concern

On the subject of HP development, the notion of sustainability often appear as a somewhat simplified concept to which often neglects the complexities that it holds. We are implying that all the MoFs, those 'taken for granted assertions' when labelled 'sustainable', should be debated. Therefore, we are arguing for a move from MoFs to MoCs as a new foundation from where one have the necessary perspective to form an opinion as to whether a solution or approach is sustainable or not. This will be the first step in a course toward augmenting current assessment guidelines, however, it is not an easy task as a multitude of viewpoints surrounding a single MoC is likely to arise. Obstacles herein occur when an actor, who takes part in a stabilised network, becomes aware of how its own interests has been displaced during a translation process. Another hindering is when an actor realises that it itself has incompatible and perhaps contradicting viewpoints regarding a specific MoC. Thus, moving away from MoFs and toward MoCs entail an exposure of black boxed knowledge, but by doing so are we then unknowingly opening up a *Pandora's box* of viewpoints? And does

such a move even make it realistic to speak of a HP future in Nepal that is sustainable in every sense of the word? Presumably not, but perhaps a more modest perception of sustainability is called for. We argue that the many areas of HP will never be equally sustainable. This is anticipated since translation processes, negotiations and the battle of becoming macro-actors in the HP network will always change. Consequently, the balance of which actors get to define and prioritise the different areas of sustainability will adjust accordingly. Therefore, a modest approach to sustainability is to reflect on how a framework can be created that assures access for actors to engage in the HP sector/network and voice their different viewpoints toward particular MoCs.

The notion of sustainability has already manifested itself in many other industries and sectors besides that of HP, but as we have argued, academia is already showing an increasing interest in the socio-technical perspectives of HP development. This is measured by the increase in citations of newly published articles with a socio-technical agenda. That being said, the different academic spheres are still very segregated due to a small representation of interdisciplinary research. In a best case scenario, one will only find technical articles that reference socio-technical articles or vice versa in what we may characterise as cross-disciplinary work. This entails the use of methods or knowledge from other scientific spheres as a perspective to a monodisciplinary analysis (Børsen, 2013, p. 40). We claim that academia, as an actor, may help other actors of an HP network in gathering a mutual understanding of one another's views on a particular MoC by interdisciplinary work. To steer academia in an interdisciplinary direction may, figuratively speaking, seem equivalent to turning around a supertanker, since the academic field is vast and literature is being published across many different countries, continents, and cultures. However, academic publications is characterised by having a very systematic form as well as predominantly being in English. Thus, there appears to be common global standards. Furthermore, citation networks play an influential role in academia that might be utilised to emphasise an interdisciplinary socio-technical agenda. Yet, optimally this is to be realised if one initiates a snowballing effect. Some universities are already supporting such a move reflected in an academic ethos of interdisciplinary. From such a position, academia may incorporate the very notion of knowledge influenced by second-degree objectivity. This knowledge may influence actors who occupy the role as gatekeepers for the materialisation of HP projects. Such positions have been visualised on the digital maps of hyperlink connections between websites. Here, it shows how Nepali government websites and HP companies are found in close proximity on the map. National as well as international development organisations are positioned in a separate cluster amounting to an intermediary position with aforementioned on one side and news agencies on the other. In the support of second degree objectivity,

these development organisations play a vital role since they frequently act as the gatekeepers of knowledge. Thereby, the development organisations are responsible for disseminating knowledge to news agencies by disclosing information on HP projects that they engage in.

A socio-technical agenda through academic interdisciplinary should not be understood as an all-encompassing solution for sustainability in HP development. Instead, it lays down a foundation to build on that advocates for different viewpoint to be heard. As earlier mentioned, we believe that an understanding of the underlying dynamics among actors and networks constitute a sound perspective from where we may explore possible recommendations. Furthermore, we argue that substituting MoFs with MoCs constitute a strong outset for proposing recommendations, which is why the third and final part of the discussion will address three concrete MoCs surrounding: awareness, technical solutions, and monitorisation.

9.3 Acquiring Access through Mobilisation of Actors

This discussion began by providing the reader with a techno-anthropological perspective that advocates for this research to look beyond legislative framework and instead focus on MoCs. Thereafter, we have discussed the profitable link between sustainability and the notion of MoCs by drawing on our digital findings. The purpose thus far has been to explore the opportunities presented in the notion of MoC, when examining the dynamics that maintains the status quo of the HP-sector in Nepal. By presenting such an understanding, we will proceed by applying content to the MoCs and discuss what kind of agency that can be mobilised in order to advocate for a realistic approach to a more modest characterisation of the term ‘sustainability’.

The first MoC, which we will address may be summed up by the word ‘awareness’. As an MoC this theme addresses the recipient of information, the deliberate lack of information that is disseminated within the HP network, and lastly, the challenges connected to accessing information. In regards to the former, information is currently made available to those citizens which HP developers have identified as being project-affected. Such a definition not only excludes citizens, who feel impacted by HP, from information, but also diminishes the agency inherent to the concerned public as an actor. This occurs when HP developers decide the number of individuals and thereby also the geographical area that constitute the actor. The issue is perhaps mostly a conceptual one, since this research has failed to identify

who HP developers include as being project-affected-people in our two case studies. This leads the second part of the theme, which address' the deliberate lack of information. This was the case at IHPP and LIHPP, where villagers claimed that they received very little information or none at all. Team leader of Care, Gautam, went as far as to call such an approach for "(...) propaganda in the name of the people (...). This entails that some HP developers do not include the concerned public in the environmental assessment studies. This assertion is supported by mechanical engineer of NHPC, Timilsina, who claims that HP companies do not always go on-site when writing up the reports. When the concerned public is not included in this process, they find themselves outside the network surrounding a HP project. In other words, their interests are not being displaced in a translation process as the concerned public has never taken part in any. The last theme of the MoC revolves around the hierarchies in the local villages. Such hierarchies are most noticeable defined by gender, which determines access to information. When HP companies disseminate information, they do it through a few elderly village men, who may also be engaged in a process resembling public participation. These men are village leaders, who has obtained the role as a spokesperson for their local communities upon a translation process. These selected few decide on what information to disseminate. Consequently, village members only receive second-hand knowledge at best and sometimes they receive no information at all. This lack of access to information, and thus also to the HP-network as a whole, withhold the concerned public from information of potential HP impacts and in turn what to demand.

In order for the concerned public to access the HP networks, we call for HP investors to act upon a moral responsibility that demands better conditions for HP development. Specifically, such actions from HP investors should come from a motivation that is beneficial to sustainability beyond monetary reasonings. Thus, we advocate for current and potential investors to put pressure on HP companies through contract agreements that demands for HP companies to periodically present transparent monitoring reports. These reports will to some extent hold HP companies accountable for their actions (or lack of), if not legally then at least publically. Such reports should be the result of cooperation between HP investors, HP companies and a concerned public. Such a holistic approach is needed for financial gatekeepers, such as investors, to understand MoCs from as many viewpoints as possible. In turn, investors may help advocate for an environmental care that matches the reality occurring in the areas around these local communities. As an actor in the HP-network, investors have an interest in maintaining a public image which reflects a high degree of social responsibility. Therefore, investors possess the agency to steer environmental assessment reports in a sound direction. Such a direction includes full disclosure of the reports and EMPs in order for anyone with interest to assess whether HP companies are meeting their commitments in practice. As these reports would still be non-independent, it is

far from being an optimal solution. Nevertheless, it is a temporary one until the young democracy of Nepal has matured to a degree where government licensed agencies are capable of taking this responsibility upon themselves.

The concerned public is one of our main actors, who currently struggle to access the HP network as it is being silenced by assessment reports that falsely assert that public concerns are being tended to. Another actor is the ecosystem whose access to the HP network is limited as it, literally speaking, has no voice and as a consequence is in dire need of a powerful spokesperson. Although, we have defined these two entities as main actors, they currently possess a micro-format in the HP network. This brings us to the second MoC, which revolves around technological solutions. The issues connected to the 10 percent downstream discharge is an excellent display of something very concrete and tangible, which impacts several aspects of sustainability negatively by suppressing the concerns of aforementioned micro-actors. For the government and HP developers, a low percentage directly affect monetary gain and thus also influence financial sustainability. Moreover, a low level discharge likewise affects the social sustainability in the local communities as the fishing potential is impaired. A low percentage also jeopardises the sustainability of the natural environment since fish migration is hindered. Thus, the dilemma is whether water availability should have priority over electricity production or vice versa. The concrete issues described above are well known and thus mitigated by implementing fish ladders. This technology is however an example of black boxed uncontested knowledge, which is perceived as a solution to the problem. Nevertheless, we have both argued and documented with photos that this is hardly the case. Legislative demands formulated in the EMPs might be adhered to, in terms of fish ladder technology and the standardised 10 percent downstream discharge. Black boxed knowledge here seems evident, when even an actor with great experience with assessment reports such as Acharya is oblivious to the establishment of the 10 percent. Yet again this is an example of the insufficiency of having legislation, and included herein, technologies, such as fish ladders, as sole solutions. Instead, the underlying problem is the uneven access of all actors to voice their concerns. If accessibility was evenly distributed, this could problematise aforementioned procedures and measures of mitigation that clearly does not work as intended.

AKWUA is a prime example of an association which, as a spokesperson, possess the capability of attending to both the concerned public and the ecosystem, however, not in its current state. AKWUA needs to be revised in a way, where it does not sustain current micro-macro dynamics of the HP network. In other words, a new version of AKWUA is needed. One that ensures public participation in pre-construction, construction and post-construction phase with the aid of an NGO, like Care, which can navigate and monitor the translation

processes. Meanwhile, such a mediator would ensure that the OPP is not set by the agenda of HP developers, the government or village leaders. We acknowledge that NGOs, as actors, are formed by their own concerns in the MoC. This concern does, however, differ from those of other actors as they are not financially engaged in HP. Thereby, they may help equalise the four main actors' access to the HP network. The importance of assigning NGOs to mediatory roles cannot be underestimated as such positions allow for amplification of concerns that are either silenced by macro-actors or are unable to be voiced. Moreover, NGOs may assure that no misconduct occurs if they are granted permission to review disclosed EMPs of HP projects. Hence, such a dynamic would realise a scenario wherein NGOs 'monitor' the 'monitors' (i.e. government agencies) in addition to observing the actions of HP companies. Similarly to what is stated in Munch-Petersen's report, NGOs should be included in EIAs (and arguably IEEs) as they can improve public engagement. Furthermore, a sense of public accountability could be a positive side-effect of such improvement. The PES concept, facilitated by Care, is an example of such improvement. The concept ensures public engagement through a socio-technical approach for the benefit of members of the concerned public, the ecosystem and HP developers. Additionally, an increase in thorough and more comprehensive public engagement would combat the vast unawareness that exists. This ignorance should be understood in terms of HP development in general as well as the demands that a concerned public can hold.

The HP reality of Nepal has revealed many interesting and worrying findings in terms of how legislative framework is either ignored or how current loopholes are being exploited. IEEs and EIAs may meet current guidelines on paper, which in turn makes the HP projects eligible for national as well as international funding. These commitments are supposed to meet EMPs, but this is often not reflected in practice. This brings us to the third an arguably most important MoC in the light of sustainability, which is monitorisation. The point of departure for any monitorisation is the IEE and EIA studies. These reports are sometimes conducted by HP consultancy firms such as Hydro-Consult Engineering (HCE), who holds both expertise and experience. However, such consultancy firms can directly or indirectly also serve to remove a sense of bias that is otherwise present when HP companies conduct these studies themselves. The alternative, portrayed by NHPC and BPC, was a scenario where HP companies would conduct non-comprehensive and non-extensive studies themselves in order to cut costs and speed up the construction phase. We argue that the continuation of such non-independent EIA and IEE practice is in risk of evolving into a malpractice, if the government continues its lack of monitorisation. This lack of monitorisation reflects an overshadowing monetary focus by the government. Consequently, the government is only prone to any action that resembles monitorisation when an HP plant for some reason is not

generating electricity. When asked if the government should continue to have monopoly in the role as a monitoring unit, NHPC and BPC disagree, however, cartel anxiety seems to be a common denominator.

An equilibrium may be the answer as a government-appointed group of consultancy agencies along with the NEA and the presence of IPPAN could create a balance of power. The EIA and IEE standards may well be upheld in face of a monitorisation that could combat the exploitation of having monitoring monopoly. If indeed EIA and IEE standards could be maintained, such would in turn serve to facilitate an access for the silenced voices in the HP landscape, i.e. the concerned public and the ecosystem. Once again, we emphasise the importance of establishing local associations such as AKWUA. If the concerned public is in support of such on-site presence of local associations, they will in turn proof to be strong a spokesperson for aforementioned. If socio-technical concepts such as Care's PES concept is implemented, it would follow that the micro positions of both the ecosystem and the concerned public as actors would be empowered. Hence, strengthening the access and position of these unprivileged actors in the HP network. IPPAN appear to have undergone translation processes to become a spokesperson for the HP companies (of this research) and could thus take on a significant role in a potential new monitorisation structure. This association of private HP developers operates as an advocacy group, which has the ability to voice concerns of many. The support and alignment of a long list of adjoined HP companies, investors, and consultancy firms holds enough power to be considered a macro-actor. Such a position brings along a significant amount of influence on HP development in Nepal, which may be applied in other ways than in order to secure entrance to the HP-sector for private investors and HP companies. Based on the motivations expressed by Pandey and Pradhan and their influential positions in IPPAN, we encourage IPPAN to exploit its position as a macro-actor and spokesperson by widening its agenda to include more all-encompassing sustainable solutions besides those of financial nature.

10. Conclusion

This thesis has opted for a close ANT affiliation in the endeavour of unfolding the HP networks surrounding two case studies. NHPC and their ownership of IHPP and LIHPP has made up the first case, while AHPP owned by BPC has made up the second case. The particularities of these cases have been applied to a wider context in order to produce analytical generalisations of the HP sector in Nepal. In this process, we have defined four main actors: HP developers, the concerned public, the ecosystem, and the government. Individually these actors comprise of yet deeper levels of networks and are dynamic in nature. The HP network found in Nepal have yet again been appended to a greater context by viewing the actors of this thesis in an international perspective through digital maps. In this wider perspective of HP, we have argued that academia already has a growing interest in socio-technical issues of HP. The outset for exploring these different arenas and levels of HP networks has been the current impact assessment guidelines in Nepal and how they may be augmented. Such an undertaking brought us beyond legislative framing of impact assessment guidelines and into the engine room, where agency and power struggles unfold in practice. From here, we have been able to identify actors with both motivation and agency to generate a shift towards greater sustainability in Nepali HP development.

By drawing on ANT framework, we adopted the notion of second-degree objectivity which has served to illuminate the controversies surrounding MoCs. In turn, MoCs have made us aware of the many and often contradicting viewpoints that are disguised as MoFs or appear as black boxed knowledge. The notion of translation has been used retrospectively to deconstruct some of the knowledge that has already been established as black boxed and MoFs. One such deconstruction concerns the issue of the 10 percent downstream water discharge, which has been put in place to preserve the natural environment. Yet, it has to a great extent falsely functioned as a resemblance of good practice. Whether HP developers actually meet the 10 percent downstream discharge is hard to tell as government monitorisation of HP projects is almost completely absent. This MoC illustrates a clash of socio-technical nature between two essentials for preservation of livelihood: electricity and water. Oftentimes the concerned public is neglected in the mandatory public engagement processes surrounding such issues. This neglect makes it difficult for the concerned public to voice any concerns and demands, since they remain unfamiliar with HP technology and its potential impacts. There is a clear ‘HP ambivalence’ present in Nepal. Most Nepalis recognise the benefits of HP, but at the same time they also express distrust and disillusion with the current state of the HP sector. Such a damaged relationship between HP and the

public is caused by repeated patterns of opportunism and corruption, which altogether is a clear indication of an unsustainable HP climate.

This thesis have argued that a sharpening of current impact assessment guidelines connected to HP is inadequate, when policy makers choose to ignore rules and regulations set by themselves. Assessment reports, and in particular EMPs, thus become worthless if the government ignore their obligations to perform HP monitorisation. In order to surpass a singular understanding of sustainability, an access into the HP debate should be facilitated for all concerned actors. Consequently, the following recommendations will move beyond legislative recommendations and into the area of mobilising actors that have interest in advocating for such a change.

1. By acknowledging the benefits of a sturdy CSR profile, HP investors should advocate for sustainability by demanding transparency through periodical reports on HP projects that they are engaged in along with full disclosure of assessment reports.
2. NGOs, which are already mobilised around a socio-environmental agenda, should interact more directly with the HP-sector and the concerned public by managing the role as an intermediary and facilitator in public participation processes during EIA and IEE studies. Concretely, this could materialise through socio-technical concepts such as PES or by establishing local on-site associations resembling AKWUA, which may speak on behalf of a concerned public. Having a greater presence of NGOs in HP development, moreover, allows for NGOs to assess already commercialised HP projects by granting them access to EMPs (cf. recommendation 1).
3. HP developers of IPPAN, who express dissatisfaction with the current state of the HP-sector should advocate for IPPAN to exploit its position as a macro-actor and spokesperson. Such a transformation would ensure that IPPAN would broaden the scope of its agenda beyond economically-driven motivations into an all-encompassing approach to sustainability.

All three recommendations should be understood as being intertwined. By realising these above stated recommendations, wider translation processes may commence in favour of socio-technical understandings. We believe this to be a sound approach to lift Nepal into a sustainable HP future that benefits all concerned HP actors within the scope of this research.

11. References

Agostinho, C., Pelicice, F., Marques, E., Soares, A. and de Almeida, D. (2011). All that goes up must come down? Absence of downstream passage through a fish ladder in a large Amazonian river. *Hydrobiologia*, 675(1), pp. 1-12.

Barroso, M. (2015). INTERNATIONAL DEVELOPMENT COOPERATION: DEBATING RELIGIOUS AND HUMANITARIAN APPROACHES IN NORWAY. *Sociologia & Antropologia*, 5(2), pp. 381-404.

Berman, R. and Tyyskä, V. (2011). A Critical Reflection on the Use of Translators/Interpreters in a Qualitative Cross-Language Research Project. *International Journal of Qualitative Methods*, 10(2), pp. 178-190.

Birkbak, A., Petersen, M. and Elgaard Jensen, T. (2015). Critical Proximity as a Methodological Move in Techno-Anthropology. *Techné: Research in Philosophy and Technology*, 19(2), pp. 266-290.

Blok, A. & Elgaard Jensen, T. (2011). *Bruno Latour: hybrid thoughts in a hybrid world*. London; New York: Routledge.

Borchgrevink, A. (2003). Silencing Language. *Ethnography*, 4(1), pp.95-121.

Butler, C. and Rest, M (2017). Calculating Risk, Denying Uncertainty: Seismicity and Hydropower Development in Nepal. *HIMALAYA, the Journal of the Association for Nepal and Himalayan Studies*, 37(2), pp. 15-25.

Butwal Power Company Limited (2017). *Annual Report 2016*. Kathmandu: Butwal Power Company Limited.

Bpc.com.np. (2018a). *Butwal Power Company (BPC)*. [online] Available at: http://www.bpc.com.np [Accessed 4 Apr. 2018].

Bpc.com.np. (2018b). *Butwal Power Company (BPC)*. [online] Available at: http://www.bpc.com.np/index.php?option=com_page&task=details&id=13 [Accessed 19 May 2018].

Børsen, T. (2013). Identifying Interdisciplinary Core Competencies in Techno-Anthropology: Interactional expertise, social responsibility competence, and skills in anthropology driven design. In: T. Børsen and L. Botin, ed., *What is Techno-Anthropology*, 1st ed. Aalborg: Aalborg University Press, pp. 35-66.

Callon, M. (1986). Some elements of a sociology of translation: domestication of the scallops and the fishermen of St Brieuc Bay. In J. Law (Ed.), *Power, action and belief: a new sociology of knowledge?* London: Routledge.

Carenepal.org. (2018). *Care Nepal*. [online] Available at: http://www.carenepal.org/projectDetail.php?id=6 [Accessed 20 Apr. 2018].

Cernea, M.M. (2004). *Impoverishment risks, risk management, and reconstruction: A Model of population displacement and resettlement*. Presented at UN Symposium on Hydropower and Sustainable Development, 27 to 29 October: Beijing, China.

Department of Electricity Development (1997). *Environment Protection Act*. Kathmandu: Ministry of Energy, Water resources and Irrigation.

Descola, P. (2005). On anthropological knowledge. *Social Anthropology*, 13(1), pp. 65-73.

Doed.gov.np. (2018a). *Department of Electricity Development, Ministry of Energy, Government of Nepal* [online] Available at: http://www.doed.gov.np/operating_projects_hydro_below_1.php [Accessed 16 Apr. 2018].

Doed.gov.np. (2018b). *Department of Electricity Development, Ministry of Energy, Government of Nepal* [online] Available at: http://www.doed.gov.np/operating_projects_hydro.php [Accessed 16 Apr. 2018].

Doed.gov.np. (2018c). *Department of Electricity Development, Ministry of Energy, Government of Nepal*. [online] Available at: http://www.doed.gov.np/survey_license_for_generation_1-25mw.php [Accessed 26 Apr. 2018].

Elgaard Jensen, T. (2003). Aktør-netværksteori. Papers in Organization, No. 48. *Aktør-Netværksteori – en sociologi om kendsgerninger, karakker og kammuslinger*. Cph: Institute of Organization and Industrial Sociology, Copenhagen Business School.

Elsevier.com. (2018). *Scopus | The largest database of peer-reviewed literature | Elsevier*. [online] Available at: https://www.elsevier.com/solutions/scopus [Accessed 16 Apr. 2018].

Eriksen, T. (2004). *What is Anthropology?*. London: Pluto Press, pp. 3-18.

Flyvbjerg, B. (2006). Five Misunderstandings About Case-Study Research. *Qualitative Inquiry*, 12(2), pp. 219-245.

GitHub. (2018). *seinecle/gephi-tutorials*. [online] Available at: https://github.com/seinecle/gephi-tutorials/blob/master/src/main/asciidoc/en/book/book-gephi-tutorials-en.adoc [Accessed 25 May 2018].

Hydropower.org. (2018). *Types of hydropower | International Hydropower Association*. [online] Available at: https://www.hydropower.org/types-of-hydropower [Accessed 7 Mar. 2018].

International Hydropower Association (2010). *Hydropower Sustainability Assessment Protocol*. London: International Hydropower Association.

International Hydropower Association (2016). IHA's Blue Planet Prize open for participation.
International Rivers. (2018). *Environmental Flows*. [online] Available at: https://www.internationalrivers.org/environmental-flows [Accessed 18 Apr. 2018].

International Renewable Energy Agency (2012). Hydropower. *Renewable Energy Technologies: Cost Analysis Series*, [online] 1(3). Available at: http://www.irena.org/Publications [Accessed 24 Feb. 2018].

Ippan.org.np. (2018). *IPPAN | Home Page*. [online] Available at: http://www.ippan.org.np [Accessed 5 Apr. 2018].

Kathmandupost.ekantipur.com. (2018). *Will scrap companies failing to complete hydro projects: Minister Pun*. [online] Available at: http://kathmandupost.ekantipur.com/news/2018-04-29/will-scrap-companies-failing-to-complete-hydro-projects-minister-pun.html [Accessed 29 Apr. 2018].

Knorr-Cetina & Cicourel (2015). *Advances in Social Theory and Methodology: Toward an Integration of Micro- and Macro-Sociologies*. London: Routledge and Kegan Paul.

Koirala, S., Hill, D. and Morgan, R. (2017). Impacts of the delay in construction of a large scale hydropower project on potential displacees. *Impact Assessment and Project Appraisal*, 35(1), pp. 106-116.

Kumar, D. and Katoch, S. (2014). Sustainability indicators for run of the river (RoR) hydropower projects in hydro rich regions of India. *Renewable and Sustainable Energy Reviews*, 35, pp. 101-108.

Latour, B. (1987). *Science in action: How to follow scientists and engineers through society*. Cambridge, Mass.: Harvard Univ. Press.

Latour, B. (2004). Why Has Critique Run out of Steam? From Matters of Fact to Matters of Concern. *Critical Inquiry*, 30(2), pp.225-248.

Latour, B. (2005a). *Reassembling the Social: An Introduction to Actor-Network-Theory*. Oxford: Oxford University Press.

Latour, B. (2005b). *What is the Style of Matters of Concern?*.

Latour, B. and Woolgar, S. (1986). *Laboratory life: The Construction of Scientific Facts*. 2nd ed. Princeton: Princeton University Press.

Lawoti, M. (2009). Evolution and growth of the Maoist insurgency in Nepal. In: M. Lawoti and A. K. Pahari, ed., *The Maoist Insurgency in Nepal*. London: Routledge, pp. 3-30.

Majumder, M. and Ghosh, S. (2013). *Decision Making Algorithms for Hydro-Power Plant Location*. Singapore: Springer Singapore, pp.15-19.

Ministry of Environment (2006). *Rural Energy Policy*. Kathmandu: Government of Nepal.

Munch-Petersen, J. (2017). *Public Participation in Environmental Impact Assessment of Hydropower Plants in Nepal: A Contextspecific Approach*. Working Papers. Colombo: International Water Management Institute.

Munk, A. (2013). Techno-Anthropology and the Digital Natives. In: T. Børsen and L. Botin, ed., *What is Techno-Anthropology*, 1st ed. Aalborg: Aalborg University Press, pp. 287-309.

Munk, A. (2014). Mapping Wind Energy Controversies Online: Introduction to Methods and Datasets. *SSRN Electronic Journal*.

NHPC (2002a). *Environmental Impact Assessment (EIA) of Indrawati III Hydroelectric Project: Vol II, Scoping and ToR Document*. (can be provided upon request)

NHPC (2002b). *Environmental Impacts Assessment (EIA) of Indrawati lll Hydroelectric Project*. Vol. 1 Main Report. Kathmandu: National Hydropower Company Limited. (can be provided upon request)

National Conservation Strategy Implementation Project (1993). Environmental Impact Assessment Guidelines, Kathmandu.

National Hydro Power Company Limited (2017). *Annual Report 2072/2073*. Kathmandu: National Hydro Power Company Limited.

Nhpcl.com. (2018). *National Hydropower Company. Ltd.* [online] Available at: http://www.nhpcl.com [Accessed 4 Apr. 2018].

Office of Technology Assessment (1995). *Fish Passage Technologies - Protection at Hydropower Facilities*. Washington DC: Congress of the United States, pp. 53-68.

Rogers, R. (2012). Mapping and the Politics of Web Space. *Theory, Culture & Society*, 29(4-5), pp. 193-219.

Rogers, R. (2017). Foundations of Digital Methods: Query Design. In M. T. Schäfer, & K. van Es (Eds.), *The Datafied Society: Studying Culture through Data*, pp. 75-94. Amsterdam: Amsterdam University Press.

Schuler, D. and Namioka, A. ed., (1993). *Participatory design: Principles and Practices*. Hillsdale, New Jersey: Lawrence Erlbaum Associates, Inc.

Sedicon.no. (2018). [online] Available at: http://www.sedicon.no/wp-content/uploads/2017/06/2016-Indrawati-Nepal-new.pdf [Accessed 12 Mar. 2018].

Schuler, D. and Namioka, A. ed., (1993). *Participatory design: Principles and Practices*. Hillsdale, New Jersey: Lawrence Erlbaum Associates, Inc.

Simons, H. (2009). *Case Study Research in Practice*. London: SAGE Publications Ltd.

Sovacool, B., Dhakal, S., Gippner, O. and Bambawale, M. (2011). Halting hydro: A review of the socio-technical barriers to hydroelectric power plants in Nepal. *Energy*, 36(5), pp.3468-3476.

Spradley, J., 1979. *The ethnographic interview*. 1st ed. New York: Holt, Rinehart and Winston.

Takyi, E. (2015). The Challenge of Involvement and Detachment in Participant Observation. *The Qualitative Report*, 20(6), pp. 864-872.

The Himalayan Times. (2018). *President Bhandari urges investors to invest in hydro sector*. [online] Available at: https://thehimalayantimes.com/kathmandu/president-bhandari-urges-investors-to-invest-in-hydro-sector/ [Accessed 10 Apr. 2018].

The Record. (2018). *Lost in hydro dreams*. [online] Available at: https://www.recordnepal.com/category-explainers/lost-in-hydro-dreams/#undefined.uxfs.uxfs [Accessed 3 May 2018].

UNDP (2018). *Payments for Ecosystem Services*. [online] Available at: http://www.undp.org/content/sdfinance/en/home/solutions/payments-for-ecosystem-services.html [Accessed 20 Apr. 2018].

Np.undp.org. (2018). [online] Available at: http://www.np.undp.org/content/dam/nepal/docs/reports/governance/UNDP_NP_Report%20on%20Assessment%20of%20Village%20Development%20Committee%20Governance%20and%20the%20Use%20of%20the%20Block%20Grants.pdf [Accessed 4 May 2018].

U.S. Department of the Interior (2005). *Managing Water in the West: Hydroelectric Power*. U.S. Department of the Interior, Bureau of Reclamation, Power Resources Office.

Vandernoot, J. and Van Hove, C. (2014). Disparities between Development Regions and District Development Committees in Nepal. *International Advances in Economic Research*, 20(3), pp. 353-354.

van Etten, J., van Koppen, B., Pun, S. (2002). *Do equal land and water rights benefit the poor? Targeted irrigation development: The case of the Andhi Khola irrigation scheme in Nepal*. Working Paper 38. Colombo, Sri Lanka: International Water Management Institute.

Venturini, T. (n.d.). *What is second-degree objectivity and how could it be represented*. [Online] Available at: https://medialab.sciencespo.fr/publications/Venturini-Second_Degree_Objectivity_draft1.pdf [Accessed 26 February 2018].

Venturini, T. (2010a). Diving in magma: how to explore controversies with actor network theory. *Public Understanding of Science*, 19(3), pp. 258-273.

Venturini, T. (2010b). Building on faults: How to represent controversies with digital methods. *Public Understanding of Science*, 21(7), pp.796-812.

Venturini, T., Jacomy, M. and Pereira, D. (n.d.). *Visual Network Analysis*. [Online] Available at: http://www.tommasoventurini.it/wp/wpcontent/uploads/2014/08/Venturini-Jacomy_Visual-Network-Analysis_WorkingPaper.pdf [Accessed 10 April 2018].

Venturini, T., Munk, A. and Jacomy, M. (n.d.) *Actor-Network VS Network Analysis VS Digital Networks: Are We Talking About the Same Networks?* [Online] Available at: http://www.tommasoventurini.it/wp/wpcontent/uploads/2014/08/Venturini-Jacomy_Visual-Network-Analysis_WorkingPaper.pdf [Accessed 10 April 2018].

ppp.worldbank.org (2018). *Power Purchase Agreements (PPAs) and Energy Purchase Agreements (EPAs) | Public private partnership*. [online] Available at: https://ppp.worldbank.org/public-private-partnership/sector/energy/energy-power-agreements/power-purchase-agreements [Accessed 10 May 2018].

Zahle, J. (2012). Practical Knowledge and Participant Observation. *Inquiry*, 55(1), pp. 50-65.

Zuiderent-Jerak, T. (2015). *Situated Intervention*. The MIT Press.

Appendix A

Overview of Informants, Organisations, and Legislation

Throughout this thesis, a particular set of informants and documents are frequently referenced or quoted. In order to prevent any confusion along the way, the aim of this appendix is to create a general overview of the informants that we draw upon as well as clarify the role and importance of certain legislative documents. Thus, the appendix provides a concise description of aforementioned, which may aid the reader throughout the thesis reading.

Informants:

Kumar Pandey:

Chairman of the board in National Hydro Power Company Ltd. (NHPC). Pandey has an engineering and MBA degree from USA. He has previously worked as a contractor on a BPC owned project. Besides working for NHPC, Pandey does consultancy work for the Department for International Development, which is a UK government organisation that works toward ending extreme poverty. Furthermore, Pandey is the vice-president of IPPAN

Naryan Timilsina:

Mechanical engineer for NHPC since 2002. Timilsina has with his years of experience in depth knowledge of the HP sector. One of his work tasks is that of a station manager at IHPP.

Pratik Man Singh Pradhan:

Vice-president for BPC and responsible for Business Development and Projects. Pradhan is an expert within HP development with more than 25 years of experience within construction, research and finance. He has a civil engineering degree from India, and a MSc in HP Development from Norway and an MSc in Environmental Hydraulics from USA. Furthermore, Pradhan is a member of IPPANs executive committee.

Pranav Acharya:

Chief of Environment and Business Development in Hydro-Consult Engineering (HCE). HCE used to be a part of BPC until the Nepal Electricity Authority (NEA) decided that the same company cannot generate and supply electricity, thus HCE became a subsidiary of BPC. For this reason, Pradhan brought us with the contact to Acharya. Acharya has an MSc in

Environmental Management from Singapore and has currently been working nine years in BPC with expertise in environmental assessments.

Dev Raj Gautam:

Team Leader in Care for the Hariyo Ban Program with the stated objective of preserving biodiversity. Gautam has an MCs in Forestry and Sociology from respectively Germany and Nepal. He has been engaged in an HP projects in Lamjung District.

Kush Dhakal:

Educational background within biology. Dhakal now works as Ward President for one of Kathmandu's 35 Wards. He has no direct experience with HP development, but he is an asset to this investigation in that he possess in-depth knowledge on legislation and more importantly has extensive experience in being an intermediary between government interests and public interests.

The concerned public:

An umbrella term used for the informants, who consist of local people in the surrounding areas of AHPP, IHPP, and LIHPP. The term is used for two reasons. Firstly, to keep some informants anonymous. None of the local informants explicitly asked to be kept anonymous, but some expressed apprehension as to what consequences their comments could potentially trigger. The second reason is one of convenience in that we believe *the concerned public* is the most concise term to be used for that part of Nepal's civil population that in some way feel affected by the impacts of HP development. Whoever this may be is decided by the individual itself, thus, not framed by us as researchers on the basis of geography, demography or anything else.

On-site staff:

Similar to the concerned public, on-site staff make up a group of people, mainly HP operators at IHPP or AHPP. For that reason, they possess valuable knowledge on the technology of HP and on current challenges that they are facing on-site. For the majority of the on-site staff it applies that they are living in the local villages, thus, they could be said to be a part of the concerned public. As a group of people, they each have individual concerns while formally representing their employers: NHPC or BPC. Furthermore, some of the on-site staff at AHPP are members of AKWUA.

Organisations:

AKWUA:

The Andhikhola Multi-Purpose Water Users Association (AKWUA) was established in 1984 during the planning phase of AHPP. It initially functioned as a platform to create awareness about HP and to engage the community people in the design and construction of AHPP. Today, AKWUA has ownership of the AHPP irrigation scheme and are responsible for distribution of irrigation water in addition to purchases and resells 'surplus' land at affordable rates to poor families in the local communities (van Etten, van Koppen and Pun, 2002, pp. 6-8).

IPPAN:

Independent Power Producer Association, Nepal or in short IPPAN, is the umbrella organisation for the private HP sector in Nepal. It advocates for 'pro-private sector' policies and tries to be the linkage between private HP companies and the government. Its overall objective is to maximise the use of HP in the country in order to satisfy Nepal's increasing electricity needs.

Legislative Documents:

NEIAG:

The National Environmental Impact Assessment Guidelines (NEIAG) is a document from 1993 containing a range of guidelines formulated by The National Planning Commission in collaboration with The World Conservation Union. NEIAG is the most explicit piece of work published in Nepal on when and how to conduct EIAs and IEEs. It is however, still a guideline which means that not all recommendations have become regulation that he assessor has to follow although the guidelines have been formulated on the basis of the contextual setting of Nepal and endorsed by the government of Nepal in September, 1992.

EPA:

The environment protection act (EPA) was published in 1997 six months prior to the EPR and is a legal provision that is enacted with the objective of maintaining a clean and healthy environment (i.e. social, flora, and fauna) by minimising impacts that may cause environmental degradation.

EPR:

The environment protection rules (EPR) is a legislative document from 1997 that is enacted on the basis of the EPA to which it adopts the NEIAGs criteria for conducting environmental

assessments. Based on the acts (from the EPA) it outlines the rules for the different legal aspects of assessments.

IEE and EIA:

In the case of any HP project in Nepal of 100 KW or greater, HP companies are required to conduct either an Initial Environmental Examination (IEE) or an Environmental Impact Assessment (EIA), which has to be documented in a report and subsequently approved by the relevant government authority prior to commencing any land excavation or construction work. There are different criteria that determines whether a HP project is subject to either one. These includes whether resettlement of local people is necessary, if the HP plant has a calculated capacity of less or more than 50 MW and if road construction to and from the site is needed. An IEE is, thus, a much smaller report that requires less resources to carry out as it does not include any impact analysis, mitigation and impact management, and review and finalisation of report. These three phases all have to be included in an EIA with a degree of public participation. In an IEE there are no legislative requirements for public participation, but it does, however, have to be approved by government authorities, who then have to consider the degree of which public concerns have been included in the report. Before a publication of an EIA, it should be made available for the public to review and give feedback for a period of 30 days. Thereafter, it is up to the HP developers to decide as to whether they want the final report disclosed to the public.

Appendix B

Interview Guides

The interview guide consist of questions, which incites answers of both an emic and an etic character. This was opted for as asking purely descriptive questions, did not always provide descriptive answers, to which cultural use could be interpreted into cultural meaning (Spradley, 1979, p. 47).

As described in chapter 7.2, the interview guides were continually rewritten when new knowledge or perspectives were obtained. These guides were additionally altered depending on who the particular interviewee was. Nevertheless, the interview guides generally fell into one of three categories: 1) the concerned public, 2) on-site HP employees, or 3) administrative HP employees. For the latter category, questions which we found more important was coloured red in order for us to make sure to ask them within occasionally limited timeframe of the interviews. Moreover, the questions was divided into themes in order to make sure to acquire answers within every theme.

Common to all interviews was a 'introduction phase' of an approximate 10 minutes' duration. The relevance of the questions asked in this phase played a minor role, since the objective rather was to establish a relaxing atmosphere and to remove any initial nervousness:

- What is your name?
- How old are you?
- What is your educational background?
- How long have you worked/lived here?
- etc.

In interviews where the interviewee displays hesitant behaviour, he or she is to be informed about the opportunity to remain anonymous and that they should feel free not to answer questions. Whether or not informing the interviewee about the option of remaining anonymous was something that we initially discussed a lot. We decided only to mention it when interviewees displayed hesitant behaviour. In our experience, as well as the advice given by Nepali friends, mentioning confidentiality before an interview may raise suspicion among interviewees as they are citizens of a country that is not shy of using questionable methods. Therefore, this could influence their willingness to take part in our investigation.

Following is the three interview guides:

1) The Concerned Public

- How do you make use of water in your daily lives?
- What has changed in your life since the construction of the HP plant?
    - How has HP affected your livelihood in particular?
- How has the HP affected the flora and fauna in the area where you live?
    - Do you eat the fish in the river?
    - Is it harder to catch fish these days?
    - How has your harvest been within the last 10 years?
    - Do you have concerns with your crops or the river?
- Has the supply of water changed due to HP construction?
- What has been done to sustain your daily life after HP construction?
- How has NHPC/BPC involved you in the process of HP construction?
    - How often did they come and talk to you?
    - Did NHPC/BPC talk to you one-to-one, in groups, in formalised meetings, or in another way?
    - How did you understand the information they provided you with regarding different impacts of hydropower?
    - Who else came and talked to you besides NHPC/BPC?
- How did NHPC/BPC make the impact report (EIA/IEE report) available for you to read?
    - Did you get a chance to understand it?
        - If so, did you have concerns?
        - If not, did you get answers from NHPC?
    - How did NHPC communicate their intentions about making HP before they started building?
    - What do you think is NHPC's main concern (in connection to their HP plants in this area)?

2) On-Site HP Employees:

- Can you tell us / show us what your role here is?

- How do you consider the employment and line of work that you have at the hydropower plant?
- What are the benefits of HP?
    - Do you see some downsides?
        - What can be done to fix these?
- How do make use of water in your daily life?
    - How has the role of NHPC (as your employer) affected your idea of that?
- What changes do you see has happened in the area before building, during and now?
- Are you local to this area?
    - If not, what is your relationship with the locals?
    - If so, do you feel a change in your role in the local community since you were employed?
- How does the local community benefit from HP?
- What can the local community teach the NHPC/BPC and their operations?
- How has your daily life changed because of both being a local in the surrounding area and at the same time working at the HP plant?
- What current challenges, if any, are you facing here at IHPP/AHPP?

3) Administrative Employees

Broad Questions:

- How do you regard the future opportunities of HP in Nepal?
    - Which challenges do Nepal face?
    - What measures do you think should be done to combat them?
- What does sustainability mean to NHPC/BPC and wherein lies your main focus?
    - How do you negotiate in between different perspectives and interests on the subject of sustainability? (economically, socially, and environmentally)

Questions related to the Impacts of HP Construction:

- How do you account for social impacts in the three phases of projects; planning, construction, and operationalisation?
- How do you at NHPC/BPC regard your public responsibility in the construction process when using subcontractors?
- How do you facilitate public participation?
    - What advantages and limitations do you see in that?

- What role do the villages surrounding HP projects play?
    - How great of an influence do concerns and requirements belonging to the local population play?
- How come local villagers were not supplied with electricity after IHPP became operational in 2002?
    - We understand that villagers in a radius of one km received a written contract saying that they would get electricity right after IHPP became operational, but they did not. What is the reason for that?

EIA/IEE related Questions:

- What is your opinion on the IHA protocol in general?
    - Do you envision some other way/improved way of conducting EIAs/IEEs that would be beneficial for you as a company as well as the local communities in the surrounding areas?
- How have you informed the villagers at Indrawati about the current standstill of LIHPP construction?
- Neither the 1993 EIA guidelines, the EPR or EPA mentions anything about the independence of writing the IEE and EIA reports. What are your thoughts on that?
- We understand that an IEE basically consists of only the ToR (Terms of Reference). Can you explain how projects that qualify for IEEs are usually carried out?
- What impacts do you predict The Electrical Regulatory Commission Act will have once in effect? On your daily work?
    - On hydropower, as a whole, in Nepal?
    - On the wellbeing of the Nepali population and their need for daily electricity?

Closing Questions:

- Do you have any last comments to add to some of the subjects we have covered?

In case of additional time:

- Can you describe the NEA in the context of HP?
    - What role does NEA have for the future of HP in Nepal?
- What is your opinion on the current state of electrical supply for Nepal?
- How do you monitor projects prospectively and keep in contact with local people in the area?

Appendix C

Hyphe Protocol and Seed List

Protocol criteria

Upon narrowing down our *seed list*, which includes the starting point of the query made through the use of Hyphe, we considered websites from the 10 leading nations in HP. Such was contemplated, since we anticipated a greater digital presence of actors in the debate in countries where HP is abundant. For practical reasons, we only included websites that are in either Swedish, Norwegian or English, as we have to be able to scrutinize them qualitatively.

Leading nations are defined by:

The highest measure of HP production in Mtoe (Million tonnes of oil equivalent). Thus, some countries may have a high HP capacity measured in GW, but a low Mtoe, which may be interpreted as a poor hydropower utilisation.

Uncrawled nodes of the network has been filtered out in the anticipation of a better result in terms of spatialisation of the network map and thus greater separation of clusters. Websites from Nepal as well as international websites have been included even if they do not meet above criteria. Having established these criteria, websites from small as well as big nations are included. Moreover, in the process of data acquisition there will be no discrimination of types of websites as long as they meet above criteria. This entails that websites may be labelled: interest/lobby organisations, blogs, power companies, news agencies, government websites, scientific magazines/journals, university websites, etc.

Methodical steps in data acquisition

1. Websites from each nation will be included in the first crawl (all crawls are performed on a depth level of 1).
2. Upon finishing the first crawl a new list of websites appear in the form of ‘neighbouring’ uncrawled websites. This is known as a horizon.
3. A qualitative screening of the horizon is performed to secure that these websites touch upon the subject of HP. Those that are found relevant enter into a second crawl.
4. Upon finishing the second crawl a third crawl is performed based on the exact same method as described in point 3.

We have thus completed an iterative process that have broadened the network three times. The result is a corpus that has been built on a snowball approach, which hinders a bias related to our own preconceptions as researchers as well as the algorithm of the Google search engine. After the first crawl only the hyperlinks on the websites will determine what will appear in the horizon. As the websites will end up as nodes, and thus actors, on our maps we have let the relations of individual actors open up the HP network to us.

The following is the seed list that amounts to the corpus of the Hyphe query:

International websites:
https://www.worldenergy.org/data/resources/resource/hydropower/
https://sustainabletechnologyforum.com/which-countries-get-the-most-energy-from-hydropower_21763.html
https://www.hydropower.org/
https://aippnet.org/sarawak-native-leader-barred-from-hydropower-world-congress/
https://undark.org/article/hydropower-dams-albania-vjosa/
https://www.ashden.org/sustainable-energy/ashden-guides/micro-hydro?gclid=CjwKCAiA78XTBRBiEiwAGv7EKvKSu01FkfVqJHLV9oqnKybjlMTHldd81DPc2DMucUS70mrRRP7otRoCWwUQAvD_BwE
http://www.icold-cigb.org/
http://energyshouldbe.org/Renewables_v_Baseload.html
https://www.enbridge.com/energy-matters/news-and-views/general-electric-wind-and-water-energy-storage
http://www.hydroworld.com/index.html
http://www.hydrosustainability.org/
http://www.inshp.org/about.asp

Nepali websites:
https://www.nepjol.info/index.php/HN/article/view/16482/13405
http://www.nea.org.np/
http://www.nhpcl.com
http://www.bpc.com.np/
http://www.nepalenergyforum.com/
https://nepalmonitor.org/reports/view/9491
http://ku.edu.np/kusl/economiclaw/?p=736
http://www.kasuwakhola.com.np/
http://www.wecan.org.np/
http://microhydro.org.np/
https://www.krishnasunuwar.com.np/2011/08/hydropower-of-nepal-slow-development/
http://www.ibn.gov.np/Bluffing%20about%20power
http://sapkotac.blogspot.dk/2011/01/politics-and-economics-of-hydropower-in.html
http://www.nepalenergyforum.com/upper-marshyangdi-2-in-limbo-as-talks-deferred/
http://www.martinchautari.org.np/index.php/information-regarding-to-donation-nepali-version/58-book-review/606-a-model-from-yesterday

http://www.fesnepal.org/publications/book_reviews/energy.htm
http://hydrosolutions.com.np/
http://www.himalhydro.com.np/
http://www.tinepal.org/events/research-reports-on-hydropower-and-public-service-delivery-released/
http://tms.com.np/?p=1562
http://www.ippan.org.np/
https://kathmandutribune.com/tag/hydropower-projects/
https://thehimalayantimes.com/finance/analysis/swot-analysis-of-nepals-hydropower-industry/
https://umh.com.np/
http://reviewnepal.com/business/nepal-army-to-invest-in-hydropower-project.html
http://energyefficiency.gov.np/article-energy_situation_nepal

Canadian websites:

http://greenangelenergy.ca/resources/hydropower/
https://www.desmog.ca/2017/07/05/what-s-future-hydroelectric-power-canada
https://journal.probeinternational.org/2009/07/24/xiluodu-hydropower-project-draws-auditors-criticism/
http://theclimateexaminer.ca/2016/04/21/when-the-glaciers-go-hydroelectric-vulnerability-and-climate-change/
http://www.mhi.ca/
https://www.cleanenergybc.org/about/clean-energy-sectors/run-of-river
http://environment.geog.ubc.ca/dam-it-the-site-c-dam-on-the-peace-river/
http://elawreview.org/articles/alternative-solutions-to-power-oversupply-in-the-pacific-northwest/
http://www.hydroquebec.com/history-electricity-in-quebec/timeline/toward-nationalization.html
https://canadahydro.ca/facts/
https://www.canadiangeographic.ca/article/interactive-map-shows-hydropower-infrastructure-canada
http://www.alternativeenergyprimer.com/Small-Hydropower.html
http://www.alternativesjournal.ca/community/blogs/renewable-energy/hydropower-and-middle-ground
https://www.theglobeandmail.com/opinion/the-dirty-news-about-clean-hydropower-projects/article32302206/
http://www.cbc.ca/news/canada/toronto/ontario-hydro-bills-1.3860314
https://www.thestar.com/news/canada/2017/05/02/two-thirds-of-canadas-electricity-now-comes-from-renewable-energy.html
http://www.bowvalleypower.net/greening-alberta-power-why-cant-we-build-more-hydro-electricity-in-alberta/
https://www.winnipegfreepress.com/opinion/analysis/western-provinces-could-benefit-from-hydro-power-384792711.html
https://electricity.ca/blog/tag/hydropower/
https://www.opg.com/generating-power/hydro/Pages/hydro.aspx

American websites:

http://www.clean-coalition.org/

http://enb.iisd.org/crs/hydro/html/ymbvol139num1e.html
http://www.renewableenergyworld.com/hydropower/tech.html
https://www.studentenergy.org/topics/hydro-power
https://www.statkraft.com/energy-sources/hydropower/
https://www.technologyreview.com/s/602508/hydroelectric-power-isnt-as-green-as-we-thought/
https://www.forbes.com/sites/jamesconca/2014/11/04/the-hidden-cost-of-hydroelectric-power/#12c3454d21af
https://www.scientificamerican.com/article/how-do-dams-hurt-rivers/
http://www.altenergy.org/renewables/hydroelectric.html
https://www.internationalrivers.org/resources/a-critique-of-the-iha%E2%80%99s-draft-hydropower-sustainability-assessment-protocol-3946
https://bnanews.bna.com/environment-and-energy/british-columbia-approves-hydropower-dam-despite-past-criticism
https://insideclimatenews.org/news/20090904/hydropowers-dirty-little-secret
https://www.c2es.org/content/renewable-energy/
http://www.hydroworld.com/articles/hr/print/volume-35/issue-2/departments/hydro-currents.html
https://www.hydro.org/
http://www.hydrofoundation.org/international-hydro-resources.html
https://www.georgiapower.com/company/energy-industry/energy-sources/hydropower.html

Norwegian websites:

http://www.lysekonsern.no/?lang=en_GB
https://www.statkraft.com/energy-sources/hydropower/
https://www.hydro.com/en/products/energy/
http://www.norskfriluftsliv.no/vannkraft/
https://www.tu.no/artikler/smakraft-er-verst-for-miljoet/245732
https://forskning.no/alternativ-energi-klima-miljopolitikk/2014/03/vannkraften-gjor-norge-helgront
http://fivas.org/vannkraft/nytt-gronnvaskende-maleverktoy-for-vannkraft/
http://www.cedren.no/Arrangementer/Event/ArticleId/3968/Vannmagasiner-vannkraft-og-klimagassutslipp-Seminar-hos-Norad-NB-Datoendring
https://sysla.no/gronn/na-apner-norges-forste-senter-for-vannkraft/
https://www.aftenposten.no/okonomi/i/wPGwP/Mener-staten-folger-for-darlig-med-i-Statkraft
https://www.adressa.no/nyheter/trondheim/2017/08/19/L%C3%A6rer-superingeni%C3%B8rer-om-vannkraft-%E2%80%93-kan-tjene-store-penger-15174828.ece
https://www.bistandsaktuelt.no/nyheter/2017/statkraft-og-norfund-skiller-lag/
https://vannforeningen.no/den-vanskelige-avveiningen/
https://forskning.no/energi-miljoteknologi/2012/05/mest-igjen-vannkraft
https://www.nrk.no/urix/protesterer-mot-norsk-vannkraft-1.3643876
https://blogg.sintef.no/sintefenergy-nb/politikk/baerekraftig-vannkraft-krever-mer-fleksible-og-omforente-politiske-grep/
http://miljoblikk.no/2015/03/vannkraft-og-balansekunst/
https://www.venstre.no/artikkel/2009/11/10/ja-til-vannkraft/
http://lanaturenleve.no/2017/ntnucedren-om-potensialet-for-norsk-vannkraft/
https://gemini.no/2017/12/ett-hundre-ar-med-vannkraft/

Indian websites:

https://scroll.in/article/802708/why-private-companies-want-to-give-their-hydel-projects-in-arunachal-to-nhpc
http://www.indiawaterportal.org/articles/power-crisis-time-go-green
http://www.sify.com/finance/ujvnl-to-add-1-600-mw-in-hydro-power-amid-criticism-news-news-klnclcgjdhdsi.html
https://economictimes.indiatimes.com/topic/hydropower-projects
https://thewire.in/161819/hydropower-projects-jammu-kashmir-fast-tracked-india/
http://www.downtoearth.org.in/news/subansiri-dam-unsafe-experts-committee--40558
http://www.himdhara.org/tag/hydropower-project/
http://www.indiawaterportal.org/articles/hydropower-northeast-potential-and-harnessing-analysis-critique
http://www.nhpcindia.com/Default.aspx?id=33&lg=eng&
http://sandrp.in/hydropower/
http://chimalaya.org/2011/12/01/why-small-hydropower-beats-big-dams/
http://www.arunachalhydro.org.in/
http://powermin.nic.in/en/content/policy-hydro-power-development
http://mnre.gov.in/schemes/grid-connected/small-hydro/
http://www.lntpowerdevelopment.com/hydro-power-projects/
http://www.eai.in/ref/ae/hyd/hyd.html
http://www.hccindia.com/core_business_inner.php?page=core_business&id=0
http://www.mdoner.gov.in/node/1307
https://www.tariniinfra.com/

Swedish websites:

https://www.jamtkraft.se/om-jamtkraft/var-fornybara-produktion/vattenkraft/hur-fungerar-vattenkraft/
https://www.naturskyddsforeningen.se/vad-vi-gor/hav/vattenkraft
http://www.energikunskap.se/sv/FAKTABASEN/Vad-ar-energi/Energibarare/Fornybar-energi/Vatten/Vattenkraft/
https://www.skekraft.se/om-oss/verksamhet/vattenkraft/
http://www.energimyndigheten.se/forskning-och-innovation/forskning/fornybar-el/vattenkraft/
http://www.alvraddarna.se/om/vattenkraft
https://www.nyteknik.se/artiklar-om/Vattenkraft
http://www.lansstyrelsen.se/skane/Sv/miljo-och-klimat/vatten-och-vattenanvandning/vatmarker-restaurera/restaurera/dammen/paverkan-vattenkraft/Pages/default.aspx
http://www.sero.se/sida49.html
https://www.studi.se/l/vattenkraft
https://www.statkraft.se/energikallor/vattenkraft-i-sverige/
https://nykoping.se/Kommun--politik/Kommunens-organisation/Kommunens-koncernforetag/Nykopings-Vattenkraft-AB/
https://news.vattenfall.com/sv/article/vattenkraft-och-renar-gar-ihop
http://supermiljobloggen.se/nyheter/2015/07/sa-kan-norsk-vattenkraft-producera-mer-el-och-exportera-till-europa-utan-att-det-byggs-nya-vattenkraftverk
https://www.holmen.com/sv/produkter/energi/vattenkraft/
http://www.miljosamverkansverige.se/Sv/projekt-och-rapporter-/vatten/Pages/vattenkraft-egenkontroll-recipientkontroll-.aspx

http://www.energiforsk.se/forskning/vattenkraft-och-karnkraft/
http://www.alltomvetenskap.se/nyheter/vattenkraft

Appendix D

Scopus Protocol

We used data from Scopus to build our Corpus, which was based on several considerations. First of all, PubMed was ruled out as it mainly contains biomedical literature. Web of Science, though containing publications within social sciences and humanities, was excluded because it is not possible to make search queries in abstracts and keywords. Thus, reluctantly ending up with either a much too narrow and incomprehensible list of results or with a too wide and topically unrelated list of results. Scopus was preferred due to the fitting advanced search options as well as the wide range of literature contained in the database. It covers technology, natural science, social science and humanities and it is the largest abstract and citation database of peer-reviewed literature (Elsevier.com, 2018).

Two corpora were extracted from Scopus, one of which contains keywords primarily affiliated with environmental impacts of HP, while the other contains keywords primarily associated with technically/engineering related topics within the subject of HP. Keywords can be said to carry the means needed to decipher a code (or a certain range of articles), but in selecting the relevant keywords it is important to remain conscious of the context in which they are most often used in relation to the subject. Keywords may be part of a specific agenda that aims to support a particular point of view. The opposite might also be the case, when an agenda seeks discredit an opposing point of view. The meaning affiliated with a keyword could change over time or be used differently depending of the arena and the cultural setting in which they are used (Rogers, 2017, pp. 81-87). To give but one example, the word *sustainability,* is an often used keyword in relation to HP. Nonetheless, since sustainability can refer to almost all academic areas within HP development it was considered too wide. The two search queries (A and B) appear as follows:

Query A: environmental search terms

TITLE-ABS-KEY("hydropower" OR “hydro power” AND "social impact*" OR "social* issue*" OR "biodiversit*" OR "environmental impact*" OR "social* responsibilit*" OR "social* responsible" OR "public engagement*" OR "environmental issue*" OR "cultural issue*" OR "environmental impact assessment*" OR "initial environmental examination*" OR "socio-technical*" OR "sociotechnical*" OR "public participation" OR "socioeconomic*" OR "socio-economic*" OR "resettlement*")*

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and

QUERY B: technical search terms

TITLE-ABS-KEY("hydropower" OR "hydro power" AND "dam" OR "energy" OR "water resource*" OR "hydroelectricity" OR "reservoir*" OR "optimi?ation*" OR "biomass" OR "water management" OR "water quality" OR "irrigation" OR "development" OR "rock mechanics" OR "hydrolog*" OR "energy storage")*

All keywords are bracketed by 'TITLE-ABS-KEY' which means that they have to appear in either the title, the abstract, or be an explicit keyword of the publication. Furthermore, the two variants: 'hydropower' or 'hydro power' had to be included in aforementioned as this is the overall subject. These were coupled with one or more keywords associated with either the social and environmental aspects of HP or the technically aspects of HP. The asterisk sign is used in the end of keywords that may have different inflections or suffixes and the question mark sign is used in words that have different spellings depending on the variant of English used in articles. To ensure that relevant keywords had not been overlooked, we used a function in ScienceScape called *Keywords Evolution* which provided us with a table of popular keywords used in the acquired publications and their popularity over time (diagram 2). Some of these keywords were relevant, but had been neglected in the initial search queries. Such was the reason as to why we performed another search query iteration, where they were included, hence enhancing the relevance of the search queries.

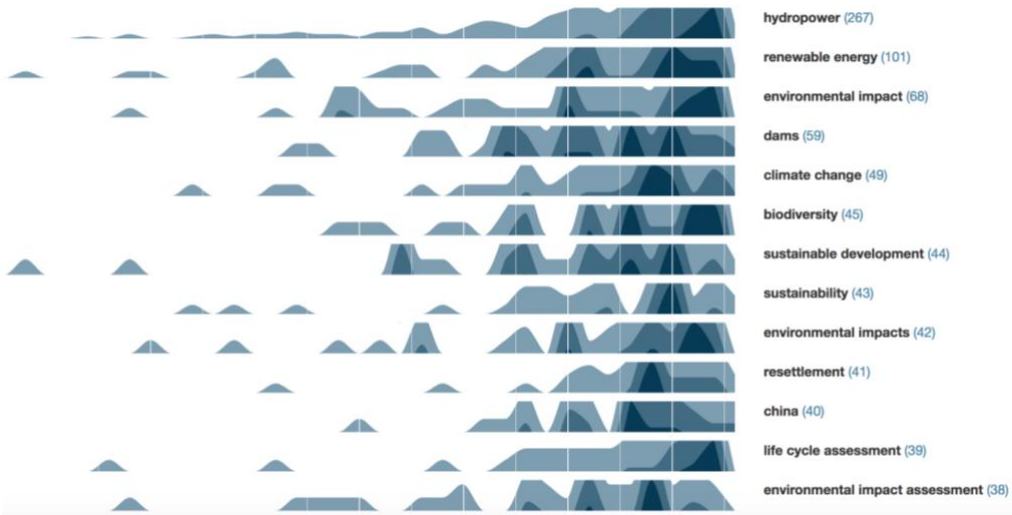

Chart 2: Evolution of popular keyword within search query A.

Search query A provided 2,060 results and search query B provided 17,710 results. Yet, it is only possible to extract CSV files of 2,000 results. Therefore, a method is needed to decide on which publications to choose due to the extensive amount of publications a quantitative method is called for. We simply chose to sort the articles based on citations, thus, having the most cited and arguably also most important publication as our first result. Defining importance on the basis of amount of citations provide an easy method to extract each of our 2,000 publications corpora.