Towards Sustainable Infrastructure: Evaluating Legal Frameworks for Environmental and Social Impact Assessment in Large-Scale Infrastructure Projects

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Abstract

Large-scale infrastructure projects have significant social and environmental impacts. An assessment of these impacts are in many countries legally required in the form of Environmental Impact Assessments (EIA) and Social Impact Assessments (SIA), with the aim of prevention and mitigation. This research examines the adequacy of legal frameworks for EIA and SIA in mitigating the socio-environmental impacts of large-scale infrastructure projects. Two case studies are analyzed: The Ivanpah Solar Power Facility, and the Grand Ethiopian Renaissance Dam. The results reveal that social impacts are insufficiently integrated into legal frameworks for EIA, aligning with the ongoing academic debate on whether social impacts should be addressed separately from, or integrated with environmental impacts. This study concludes that existing legal frameworks need to be adapted to incorporate guidelines for social impact assessments within the EIA process. Recommendations include broadening the definition of environmental impacts to include socio-economic aspects, and implementing guidelines for components of social impact assessments, such as identification of impacts on different social groups separately, ensuring participation of indigenous people, and exploring opportunities for benefit-sharing. Such adaptations are crucial for an effective prevention and mitigation of socio-environmental impact of large-scale infrastructure projects.

Key words: Environmental Impact Assessment (EIA), Social Impact Assessment (SIA), Legal Framework, Socio-environmental impacts, Large-scale infrastructure, Grand Ethiopian Renaissance Dam, Ivanpah Solar Power Facility

01. Introduction

Large-scale infrastructure projects, such energy facilities, roadways, and railroads, have a significant and complex impact on the surrounding environment as well as on the communities in which they are located (Dunović et al., 2014). These projects have broad implications extending into the fields of economy, society, and the environment (Hudon & Floricel, 2023). They could trigger complex societal changes, disturb the harmony of the environment, and create changes in landscapes. Some of these consequences include increased pollution, disruption of ecosystems, shifts in social dynamics, economic inflation, and the loss of people's livelihoods.

In the past, project planning and design has mainly focussed on economic viability while neglecting social and environmental sustainability (Willar et al., 2020). This narrow perspective has led to instances of marginalization of vulnerable people and to excessive degradation of natural ecosystems (Fisher, 2010). For example, indigenous peoples that are displaced by large dams or pollution caused by mining practices that are harmful to people as well as nature. In the last decades, the awareness about a more holistic approach, including economic, social and environmental sustainability, has created a shift in the practices of project planning and design, for example with the emergence of Environmental Impact Assessment frameworks in the National Environmental Policy Act (NEPA) in the United States in 1969.

The infrastructure development sector faces two major issues that are common to both industrialized and developing countries, underlining the role of sustainability. Firstly, utilities like waste management and water supply, as well as vital infrastructure like highways, trains, and electricity grids, are being greatly impacted by the ongoing trend of global urbanization (Lufumpa & Yepes, 2017; PricewaterhouseCoopers, n.d.). Second, the threat of climate change has highlighted the necessity for sustainability, calling for infrastructure that is resilient. At the same time, significant investments in renewable energy infrastructure are required as part of the global effort to mitigate and minimize the effects of climate change (Ding & Somani, 2010; PricewaterhouseCoopers, n.d.). Therefore, there is an increasing need to both start large-scale infrastructure projects for future resilience and update the current

infrastructure for adaptation. Ignoring the need for social and environmental sustainability would have negative effects on ecosystems that support human societies, as well as on human societies themselves.

When assessing proposed projects for possible environmental and social implications, two crucial procedures are used: the Environmental Impact Assessment (EIA) and Social Impact Assessment (SIA). The goal of an EIA is to detect, anticipate, and mitigate the consequences of planned initiatives on the environment, from industrial operations to infrastructural development (Ogola, 2007). The SIA, on the other hand, focuses mostly on the possible social impacts of projects that are being considered, including how they can affect communities, livelihoods, cultural heritage, and social cohesiveness. SIAs evaluate the social impacts of projects in an effort to protect the welfare of impacted communities and advance inclusive and equitable development results (Ogordnikova et al., 2024). By incorporating social and environmental factors into project planning and decision-making processes, EIAs and SIAs work together to promote sustainable development.

There is a substantial body of literature reviewing good practices for EIA and SIA. These good practices include guidelines, methods and in some instances case studies to illustrate how EIAs and SIAs can be used effectively. However, literature on how existing legal frameworks for EIA and SIA perform against these good practices is limited. To fill the research gap between good practices of EIA and SIA, and how these are implemented in legal frameworks, the following research question is proposed:

"To what extent do legal requirements for Environmental Impact Assessment and Social Impact Assessment prevent and mitigate the socio-environmental impacts of the construction and operation of large scale infrastructure projects?"

The legal frameworks for EIA and SIA will be evaluated against an analytical framework of good practices, by utilizing two case studies. This research identifies gaps in the legal framework that can result in limited effectiveness of EIA and SIA requirements. By identifying these gaps, improvements can be made in the legal framework to enhance the efficiency of EIA and SIA requirements in mitigating and preventing socio-environmental consequences.

This study explores two case studies: the Grand Ethiopian Renaissance Dam and the Ivanpah Solar Power Facility in California, USA. These selections were made because they have both similarities and differences. The selection of the two case studies is based on their recent construction, operational status, diverse economic environments, and the specific nature of renewable energy infrastructure projects.

The following section concisely outlines the methods used for this research. This is followed by an exploration of the literature on the socio-environmental impacts associated with large-scale infrastructure projects, focusing specifically on solar thermal installations and large hydro-electric dams. This section aims to provide readers with a foundational understanding of the challenges that EIA and SIA aim to address and mitigate. Subsequently, a literature review is conducted to examine existing literature on good practices of EIA and SIA. From this review, an analytical framework is derived to guide the structured analysis of the two selected case studies—the Ivanpah Solar Power Facility and the Grand Ethiopian Renaissance Dam. The national and regional legal frameworks for EIA and SIA that are relevant to the case studies are evaluated, and linked to the performance of EIA and SIA of those particular cases. In the discussion section, the results of the analysis are critically examined and compared, providing insights into the strengths and limitations of current EIA and SIA practices. Finally, the conclusion summarizes the findings, reflects on their implications for sustainable infrastructure development, and offers recommendations for future research and policy.

02. Methods

The following section outlines the methodology used for conducting this research to answer the research question "To what extent do legal requirements for Environmental Impact Assessment and Social Impact Assessment prevent and mitigate the socio-environmental impacts of the construction and operation of large scale infrastructure projects?". The study consists of two main components. First, a literature review from which an analytical framework is derived. Secondly, the application of the analytical framework to two case studies of large-scale infrastructure projects.

02.1 Approach

In order to investigate the extent to which legal frameworks for EIA and SIA prevent and mitigate the socio-environmental impacts of large-scale infrastructure, two case studies are analyzed, which have both differences and similarities. The case study approach is taken because legal frameworks differ across different jurisdictions. It is therefore more valuable to look at them on a case to case basis. Accordingly, this study does not only look at the legal frameworks for EIA and SIA within a specific country, it also focuses on two specific infrastructure projects. The two case studies were chosen based on their recent construction, operational status, diverse economic environments, and the specific nature of renewable energy projects. This project-specific approach is chosen as legal frameworks are often designed in a way to ensure flexibility, so that they are applicable to a variety of different cases (Baron, 2023). An analysis based on a generalized and flexible legal framework is thus less likely to yield useful results compared to an analysis of a specific project that is subject to the legal framework in question. Two case studies will be analyzed, so that differences and similarities between them can be identified, and the cases can be compared to each other. By comparing two cases, the strengths and weaknesses of each legal framework can be more clearly identified and recognized (TASO, 2022).

02.2 Analytical framework

In order to create an analytical framework to analyze the case studies, a literature review was conducted. The aim of the literature review is to identify crucial components of EIA and SIA frameworks. The literature review was conducted for EIA and SIA separately, but the approach was identical. The main topic for the literature review is “good practices for EIA/SIA”. Other key words that were used are “legal framework for EIA/SIA” and “EIA/SIA processes”. After initial literature review the key words were refined to more specific issue areas, e.g. “EIA/SIA authorities”, “public participation in EIA/SIA”, “follow-ups in EIA/SIA”. Academic articles, journals and book chapters were used as references and were collected via Google Scholar.

Five main themes emerged from the relevant academic literature: legal obligations and institutional coordination, significance of impacts, public engagement, mitigation and enhancement measures, and monitoring and enforcement. These main themes serve as the foundation for the analytical framework. The literature review then identifies good practices and characteristics of a strong and effective legal framework for EIA and SIA. These characteristics are translated into a set of research questions, separated into five main themes, that can be answered in the context of the case studies. This analytical framework is not specific for the case studies that were selected for this research, and can therefore be applied to other cases in a similar fashion. The framework itself is presented in **Table 1,** which can be found in **Appendix A**. This study adopts a selective application of the developed analytical framework, and only the most important elements have been used in the analysis of the two case studies. This approach ensures a more targeted and in-depth analysis. The core of the analytical framework is presented in **Table 2**.

Table 2:
Core Analytical framework to be used for case studies

Environmental Impact Assessment	
Legal obligation and institutional coordination	Is there a legal obligation to conduct an EIA?
	Are evaluation criteria clearly identified?
Consideration and significance of Environmental Impacts	Which environmental impacts are considered as significant?
	Are secondary or indirect impacts included besides the direct environmental impacts?
Public engagement	Is citizen participation legally required?
Mitigation and enhancement measures	Does the legislation require exploration of alternatives to minimize environmental impacts?
	Are mitigation plans a compulsory component of the EIA report?
Monitoring and enforcement	Is there a legal requirement for the implementation of follow-ups and monitoring systems?
	Does the competent authority have coercive power to ensure that the mitigation measures as proposed in the EIA report will be implemented?
Social Impact Assessment	
Legal obligation and institutional coordination	Is social impact assessment an obligatory component of the EIA, or is a separate SIA required?
Consideration and significance of social issues	Are social impacts identified for vulnerable groups, such as indigenous people, women, and the poor?
	How is the significance of social impacts determined?
Public engagement	Is public engagement legally required?
	Is participation accessible for indigenous people?
Mitigation and enhancement measures	Is an exploration of benefit-sharing opportunities required?
	Does the legislation require exploration of alternatives?
Monitoring and enforcement	Does a regulatory agency enforce compliance?
	Is monitoring legally required?

02.3 Data collection for case study analysis

For the application of the analytical framework to the case studies, a variety of sources are used, such as news articles, information provided by the project developer of the case studies, government documents, legal documents, official EIA and SIA reports, and scientific articles, journals and book chapters. These documents were accessed via Google Scholar, government websites, company websites, and official news platforms.

For the case study of the Ivanpah Solar Power Facility, the National Environmental Policy Act (NEPA) (1969), and the California Environmental Quality Act (CEQA) were analyzed as the legal framework. For the analysis of how the legal principles were applied the final Environmental Impact Statement by the Bureau of Land Management, and the Record of Decision were analyzed. For the case of the Grand Ethiopian Renaissance Dam, the Environmental impact assessment proclamation No. 299/2002 was considered. Additionally, the procedural guidelines for EIA of the federal Environmental Protection Authority (EPA) were evaluated. State-level legislation is not evaluated because of inaccessibility of these legal documents. For the analysis of the application of the legal principles, a report of an International Panel of Experts is evaluated. This document shortly reviewed the contents of the Environmental Impact Statement (EIS) of the Grand Ethiopian Renaissance Dam. This report was used as a proxy because the official document is not publicly available.

02.4 Selection of case studies

The two case studies were selected based on a set of criteria and the decision is based on a process of elimination. First of all, in order to have a useful and relevant analysis, the projects had to be constructed recently. Since concerns about social and environmental sustainability are an emerging topic and little attention has been paid to this in the past, it is not relevant to consider cases which have been constructed when this was not yet or to a lesser degree, taken into consideration. Therefore, only projects of which the construction started after the year 2000 were taken into consideration.

Large scale infrastructure projects take multiple years to complete. Since the research question focuses on the socio-environmental impacts of the construction and operation of the large-scale infrastructure project, the projects need to be at least taken into operation in order to qualify as a case study. Infrastructure projects that are not yet in operation do not yet impact the socio-environmental system to its fullest extent. This eliminates many projects which are still under construction and not yet in operation.

Another criteria is the state of development of the country in which the project is located. For the purpose of having a diverse analysis, this study focuses on one case study in a well-developed economic environment, and one case study in a less developed economic environment. The hypothesis is that the less developed country prioritizes economic development over social and environmental sustainability to a higher degree than a developed country (Mubanga and Kwarteng 2020; *Sustainable Development Report 2023*, n.d.). Besides that, a comparison can be made between the Global North and the Global South. In comparison, the institutional capacity in the context of environmental management, is greater in the global North than in the global South (Ogunbode, 2022; Setzer & Benjamin, 2019). By comparing two case studies of both the Global North and South, it can be analyzed whether this is reflected in the legal frameworks for EIA and SIA.

The following criteria are related to the nature of the infrastructure project. First of all, the projects that are considered as possible case studies are renewable energy projects. These are chosen because their social and environmental impact is often overlooked, as they are considered beneficial and sustainable development projects. Given the controversy regarding the safety and sustainability of nuclear power, I will not use these as case studies for this research. Secondly, the projects have to be constructed in one location, which eliminates projects such as roads, railways and energy grids. This is because these projects have impacts on a larger scale, and they can easily cross the borders of jurisdictions. This would result in a too complex context for this analysis.

Legal frameworks for EIA and SIA should be applicable to all types of infrastructure projects (Ogorodnikova et al., 2024). To be able to examine whether this is the case, I have decided to look into two different types of infrastructure.

Following this list of criteria, a few large-scale infrastructure projects remain as possible case studies. Possible case studies include solar power facilities and one hydro-electric dam. The Grand Ethiopian Renaissance Dam was selected as the first case study, since this was the only qualifying hydroelectric dam project. According to the United Nations, Ethiopia classifies as a least-developed country (*United Nations*, n.d.). Therefore, the second case study has to be located in a developed country, which limits the options to solar power facilities in the USA, of which the Ivanpah Solar Power Facility has the highest generating capacity. It is likely that a higher generating power relates to a higher degree of socio-environmental impacts due to size. Therefore, the Ivanpah Solar Power Facility is selected as a second case study.

03. Socio-Environmental Impacts of Large Scale Infrastructure Projects

In the following section the social and environmental impacts of large scale infrastructure are explained, with a focus on solar thermal power facilities and large hydro-electric dams. The aim of this section is to provide insight into the very issues that EIA and SIA are supposed to be preventing and mitigating.

Large-scale infrastructure projects, such as dams, inherently bring about significant changes to their surrounding environments. Construction activities at the dam site kickstart socio-environmental impacts, leading to various externalities. These include environmental hazards from excavation sites (Gourley & Greening, 1999), pollution from construction activities (Zolfagharian et al., 2012), and population influxes due to labor demands, which indirectly affect health, security, and local cultures (Mudzengi, 2012; Rousseau, 2019; Tajziehchi et al., 2022). Furthermore, the creation of reservoirs directly affects communities by flooding houses, infrastructure, cultural sites, and natural habitats (Lima et al., 2024; Shkurti, 2022; De Sousa Lopes & Brito, 2021). The resultant involuntary resettlement carries social and economic costs, compounded by losses in agriculture, forestry, and biodiversity (Hess & Fenrich, 2017; Católico et al., 2021). Overall, water quality degradation and the proliferation of water weeds pose additional challenges, impacting disease vectors, water quality, navigation, recreation, and fishing (Antentas, 2009; Liquin & Ahmed, 2023; Rousseau, 2019). Fish migration paths are obstructed, affecting ecosystems and local livelihoods, while changes in water flow, sediment retention, and seismicity further compound environmental concerns (De Sousa Lopes & Brito, 2021; Liquin & Ahmed, 2023). Upstream impacts involve forced displacement of communities, particularly affecting indigenous groups reliant on local resources (De Sousa Lopes & Brito, 2021). This displacement leads to social and land use changes, loss of livelihood, food insecurity, and dependence on external resources (Antentas, 2009; Lima et al., 2024). Downstream, changes in flow regime, water quality, and flooding affect fisheries, agriculture, and municipal water supply, with associated health and environmental implications (Rousseau, 2019; Antentas, 2009; Lima et al., 2024; Católico et al., 2021). Despite some positive societal effects, such as improved energy access, hydro-electric dams often exhibit an unequal distribution of

burdens and benefits, leading to tensions within and between communities (Hess & Fenrich, 2017). International tensions may also arise in transnational river settings, where downstream populations bear externalities without reaping the benefits (Liquin & Ahmed, 2023; Antentas, 2009).

Large-scale solar thermal power facilities, which play an important role in the global energy transition, present socio-environmental impacts similar to large dam construction projects (Hamed & Alshare, 2022; Kylili et al., 2018; Mahajan, 2012). These impacts encompass aesthetic disruptions, chemical releases, land use changes, and health risks (Tsoutsos et al., 2005; Bošnjaković & Tadijanović, 2019). Life cycle assessments reveal environmental impacts, from raw material extraction to construction, with fossil fuel combustion contributing to global warming and acidification (Kylili et al., 2018; Bošnjaković & Tadijanović, 2019). The locations of the infrastructure project experience soil degradation, vegetation loss, and water resource challenges (Holbert & Haverkamp, 2010; Terrapon-Pfaff et al., 2020). Health hazards, such as temporary vision loss and chemical leakage, pose risks to both human health and ecosystems (Mahajan, 2012; Rahman et al., 2022). Furthermore, altered microclimates can impact thermal balance and ecosystem species (Mahajan, 2012; Tsoutsos et al., 2005). While some studies indicate minimal effects, others highlight concerns like increased vehicle activity leading to invasive species proliferation and fire risks (Tsoutsos et al., 2005; Hamed & Alshare, 2022).

Social impacts encompass strengthened family ties, increased local pride, and improved living conditions alongside tensions from unequal benefits distribution, potentially altering social structures and cultural traditions (Terrapon-Pfaff et al., 2019). Economic implications include regional development and entrepreneurship growth, but also inflated prices, decreased livelihoods, and unequal labor conditions (Terrapon-Pfaff et al., 2019). These multi-faceted impacts demonstrate the challenges of integrating solar thermal power facilities sustainably into the energy landscape.

04. Literature Review: Good Practices for EIA

The following section explores the existing literature on practices for EIA, focussing specifically on good practices. This literature review forms the basis for the analytical framework that is applied to two case studies to review the effectiveness of legal frameworks for EIA to prevent and mitigate socio-environmental impacts.

EIA is an environmental management tool that is used in the legal frameworks of most countries, as well as in international law and standards of lending institutions (Ogola, 2007). The goal of EIA's is to support project licensing with technical and scientific knowledge on the likely environmental impacts of the project with the aim to eliminate, reduce, or mitigate the environmental impacts (Guerra et al., 2015).

Systems for EIA vary from country to country. There can be different authorities and government bodies involved. National legislation can include a requirement for an EIA to be done in a specific manner, and for certain projects (Ogola, 2007). The projects for which an EIA is mandatory are often defined in a list (Ogola. 2007). Usually, the regulatory authorities that are responsible for the EIA set out the Terms of Reference (ToR), which sets out the expectations for the EIA.

Many countries provide lists of types of projects for which an EIA is obligated, and a second list of projects for which it is decided on a case-by-case basis whether the preparation of an EIA is necessary (Stookes, 2003). This is a screening threshold to avoid spending time and effort on projects with no significant impacts on the environment. If there is no clearly defined threshold, the screening decision on whether an EIA is required can be influenced by political will (Zhang et al., 2013). Many thresholds are politically set to identify ranges of high risks and likely harm to human health and the environment. Some environmental impacts are easy to quantify for determining a threshold, but some, mainly socio-economic impacts, are not. For the impacts that are easily quantified, it is important to consider the situational complexities and the distinction between safe and harmful impacts (Glasson, 2008). Thresholds can be based on a set of different things. First of all, the thresholds can be formulated based on the nature of the project, which are the environmental impacts in relation to the size of the project, or based on the nature of the environmental impacts, which is what specific environmental impacts arise from the project.

Besides that, the screening threshold can be spatial or a-spatial. A spatial aspect could be, for example, that the thresholds are stricter in specific areas, such as national parks (Glasson, 2008).

During the scoping phase of the EIA, all possible environmental impacts of a project should be considered, and significant issues are further analyzed (Ogola, 2007). However, several case studies conducted by Staerdahl et al. (2004) have found that what environmental impacts are considered significant differs among countries. The screening thresholds discussed before are important measuring tools to determine the significance of environmental impacts (Glasson, 2008). Many legislative, policy and information documents, as well as guidelines for EIA's use the term "significance" when discussing environmental impacts. However most of them fail to define what is considered as significant (Duinker & Beanlands, 1986). Andrews et al. (1977) proposed a set of criteria to determine the significance of environmental impacts: Magnitude of the impact; spatial extent of impact; duration of impact; probability of occurrence of the impact; confidence in the impact prediction; existence of 'set values; the controversy surrounding the development program. Based on this set of criteria, a classification could be made based on the severity of the impact. This classification usually consists of major, moderate, minor and insignificant impacts (Duinker & Beanlands, 1986).

According to Robinson (1992), EIA works best when there is an independent authority overseeing the process and in charge of the final decision. The review body should be competent, accredited and independent from the project proponent to reduce bias. Potential biases are reduced when there are clear evaluation criteria to reduce subjectivity (Zhang et al., 2013). Besides the overseeing authority, it is also important that the EIA practitioners are independent and objective. When practitioners are financially dependent they are exposed to potential attempts of influence and they can become biased (Zhang et al., 2013).

Citizen participation can be implemented at multiple levels within the EIA process. Public empowerment boosts public awareness and informs citizens of their rights. It also results in a better understanding of the relevant issues arising from a development project (Stookes, 2003). In some EIA systems, citizen participation is a legal requirement. However, the question remains whether the input of

citizens is considered in practice (Zhang et al., 2013). There are different levels of citizen participation, In the most moderate form, citizens are allowed to speak at public meetings. Citizens have more power when they are able to appeal to a decision made. The most powerful form of citizen participation is where citizens are actively involved in the decision making process (Stookes, 2003).

Substantive impact is the effect that the EIA process has on the decision making, and whether and to what extent it actually reduces environmental impacts (Loomis & Dziedzic, 2018). The substantive impact can be increased when there is a legal requirement to implement monitoring systems and follow ups to check whether mitigation plans proposed in the EIS are complied with. Within some legislations, mitigation plans are obligatory components of an EIA report, and these have to be complied with (Arts et al., 2001; Zhang et al., 2013). These legal obligations are better complied with when the competent authority has coercive power to ensure compliance. Soft control has proven to be significantly less effective (Arts et al., 2001). The quality of monitoring is higher if local communities have the opportunities to be included. They have valuable knowledge about the local environment, and it improves transparency and communication (Arts et al., 2001). Besides that, some EIA systems require project proponents to consider alternatives with lesser environmental impacts. If this is a legal requirement, it can increase the substantive impact of Environmental Impact Assessments (Zhang et al., 2013).

05. Literature Review: Good Practices for SIA

The following section explores the existing literature on practices for SIA, focussing specifically on good practices. This literature review forms the basis for the analytical framework that is applied to two case studies to review the effectiveness of legal frameworks for EIA to prevent and mitigate social impacts from large-scale infrastructure projects.

Social impacts are inadequately included within EIA (Ogorodnikova et al., 2024). An analysis of social impacts is required in most forms of EIA, however the social impacts are rarely the focus of these analysis. Besides that, if it was decided that no EIS was required because of the insignificance of the

environmental impacts, the social impacts are ignored as well (Freudenburg, 1986). Therefore, a separate process for social impacts assessment started emerging.

Ogorodnikova and colleagues (2024) have identified desired practices for SIA and have divided these into several categories: Regulatory consistency and institutional coordination; consideration of social issues; public engagement and access to information; mitigation and enhancement measures; and monitoring and enforcement. First of all, within the category of regulatory consistency and institutional coordination, it was found that it is important that the legal frameworks covering social issues should be consistent at all levels and scales. For example, there has to be a consensus on what social issues entail, and how it would be measured (Vanclay, 2006). It should clearly identify responsible authorities for SIA review, decision-making, and monitoring processes, as well as clearly identified and distinct responsibilities (Ogorodnikova et al., 2024). Well established institutions are essential for a SIA to create benefits (Takyi, 2014). Tasks and responsibilities of other parties involved should be clearly defined (Vanclay et al., 2015). Besides this, it is important to consider the objectivity and influence of the practitioners of the SIA (Ogorodnikova et al., 2024; Lockie, 2001). There are many organizational forms that can influence the process as well as the outcome of SIA, such as political parties, government agencies, financing organizations and project proponents (Howitt, 2011; Kemp, 2011). On the other hand, practitioners often have a dual role as advocates for the impacted communities, but there is a power imbalance between the representatives of the impacted communities and the proponents. One method by which this could be mitigated is when the proponent gives financial support to the community, so that they have the resources to conduct a community-based SIA (Vanclay et al., 2015). If the burden of costs of conducting a SIA falls on the community, they are likely not able to afford it. If the burden falls on the government, they have political influence in the outcome (Takyi, 2014). Lastly, the assessors of SIA should be properly trained to assess the social impacts, and regulatory agencies should be sufficiently capable to review the reports (Takyi, 2014; Vanclay, 2006).

Within the category ‘consideration of social issues’, it is crucial that the legal framework requires a screening procedure to determine the level of SIA to be applied, in which social impacts on vulnerable

people, economically disadvantaged groups, and differences between genders should be considered (Esteves et al., 2012; Ogorodnikova et al., 2024). Both the social impacts, and the impacted people should be determined (Dani, 2003; Lockie, 2001). The process should include the scoping of social issues (Esteves et al., 2012; Kemp, 2011), requiring stakeholder input and a project response. The significance of impacts should be determined and prioritized (Vanclay et al., 2015). According to Ogorodnikova (2024) the assessment should cover specific social issues like community health and safety, occupational health and safety, working conditions, indigenous people, resettlement and livelihood restoration, cultural heritage, and project-induced in-migration. However, in practice, there is no consensus on what social impacts are legitimate to consider (Vanclay, 2006). Baseline data on identified social components should be required (Esteves et al., 2012), including disaggregated data on vulnerable groups and gender. Opportunities for benefit-sharing with surrounding communities should also be identified.

As for public engagement and access to information, it is important that the legal framework identifies potential issues and interests from all stakeholders, including government agencies, vulnerable groups, local communities, and NGOs (Howitt, 2011; Ogorodnikova et al., 2024). In order to get a comprehensive understanding of potential issues from different perspectives, it is important that the process includes community participation (Takyi, 2014). Legal frameworks for SIA should provide requirements and guidelines for public engagement and consultation, including ongoing engagement throughout the project lifecycle (Takyi, 2014). Mechanisms to promote and facilitate stakeholder input, and agreement-making processes should be in place (Esteves et al., 2012; Vanclay et al., 2015). Extra attention should be paid to indigenous people. This is because indigenous people have unique and profound ties to the land and that makes them more vulnerable to the impacts from activities that alter the lands and natural resources (Vanclay et al., 2015). Community engagement mechanisms should be accessible to indigenous people, and they need to have sufficient influence (Lockie, 2001). Community engagement is best implemented at an early stage in the project planning, since it has a higher chance of influencing choices and the design of policies and programs (Dani, 2003; Lockie, 2001). Next to that, community members should be fully informed about the project, the impacts, and how they can be

involved, and what their rights are (Vanclay et al., 2015). It should also outline requirements for disclosure and access to environmental and social information, such as SIA studies and management plans, government decision-making criteria, and benefit-sharing agreements (Ogorodnikova et al., 2024). In addition, the language used should be clear and simple, to minimize any knowledge and expertise gap between the SIA practitioners, the proponent, and the community (Takyi, 2014).

In terms of mitigation and enhancement measures, SIA review should require management plans for social issues, including measures for vulnerable groups and genders (Kemp, 2011). These plans should be required to enhance local community benefits, including local employment plans and capacity building (Ogorodnikova et al., 2024; Vanclay & Esteves, 2011). Conducting SIA is only beneficial if its findings and recommendations have influence on planning and decision making (Kemp, 2011; Takyi, 2014). A social impact management plan will ensure that there is an ongoing process of mitigating social impacts, instead of merely an ex ante requirement (Vanclay, 2006). Emergency preparedness plans should also be required to cover surrounding communities in case of project incidents, pandemics, or climate change-related disasters (Ogorodnikova et al., 2024). According to Vanclay (2015), alternatives should also be explored (Esteves et al., 2012). The social impacts should not merely be identified, but the analysis should also shape the decision-making process and alter the project plans (Vanclay et al., 2015).

Finally, for monitoring and enforcement, proactive measures should be in place to promote compliance with Social Impact Management Plans (SIMP) (Esteves et al., 2012; Lockie, 2001) and to meet social performance commitments, such as not allowing construction permits before resettlement (Ogorodnikova et al., 2024). Competent authorities should oversee the monitoring of social impacts, inspections and enforcement (Esteves et al., 2012; Takyi, 2014). Participatory monitoring mechanisms are necessary for managing environmental and social issues of concern to affected communities (Ogorodnikova et al., 2024).

06. Case Study One: The Ivanpah Solar Power Facility

The analytical framework derived from existing literature is applied to a case study of the Ivanpah Solar Power Facility in California, USA. The project was certified by the California Energy Commission on September 22, 2010. Construction began a month later, in October (California Energy Commission, n.d.). The power plant has been in commercial operation since Januari 2014 (*IVANPAH*, n.d.).

The Ivanpah Solar Electric Generating System in California provides renewable energy to 140.000 homes (*Ivanpah Solar Electric Generating System | Bechtel*, n.d.) and offsets over 400,000 tons of carbon dioxide emissions annually . It creates over 2600 construction jobs and 61 permanent jobs (*Ivanpah Solar Electric Generating System, California, USA*, 2019). However, the plant also has negative social and environmental impacts, including the deforestation of endangered species, dust pollution, and water shortages in nearby communities (Wainwright, 2023).

The legal system in the USA is a combination of both federal and state jurisdictions. The power is divided between the national government and the individual state governments. Regulations related to EIA and SIA obligations are intertwined in both federal and state courts. For example the National Environmental Policy Act requires EIA for certain projects (*National Environmental Policy Act | US EPA*, 2024), but states can also have their own environmental protection laws (*Environmental Regulations by State (2023) | Transect*, n.d.). Therefore, the analysis includes both regulations on national and state level. The detailed analysis can be found in **Appendix B**. The results are summarized in **Tables 3 and 4**.

07. Case Study Two: The Grand Ethiopian Renaissance Dam

The analytical framework derived from existing literature is applied to a case study of the Grand Ethiopian Renaissance Dam (GERD) in the Benishangul-Gumuz region in Ethiopia. The hydroelectric dam is one of the largest hydroelectric dams in Africa and its planned generating capacity upon completion is 5150 megawatts (*The Grand Ethiopian Renaissance DAM Project – Ethiopian Electric Power*, 2024). The project is owned by Ethiopian Electric Power Corporation (EEPCO). The construction of the dam started in April 2011 (*Grand Ethiopian Renaissance Dam Project, Benishangul-Gumuz*, 2020). The dam started producing electricity in February 2020 (*Ethiopia Completes 94% of Controversial Renaissance Dam*, n.d.).

The dam provides renewable energy to the Ethiopian Electricity grid, as well as economic opportunities and development. However, the dam is also highly controversial, mainly due to its impacts on downstream regions where the water flow of the Blue Nile River is restricted (Mbaku, 2020).

In the federal Democratic Republic of Ethiopia, the authority responsible for environmental protection is the Environmental Protection Agency (EPA), which is formerly known as the Environment, Forest and Climate Change Commission (EFCCC) (*ESIA/SEA per Country - Eia.nl*, n.d.). Ethiopia is a federal country, which means that the states have their own legislation and responsible authorities for environmental protection. In the Benishangul-Gumuz state, the responsible agency is the Environment, Forest and Land Administration Bureau. Unfortunately, not all states have their legislation publicly available, which is the case for this region. State legislation however, does not differ much from the federal legislation (*African Environmental Assessment Legislation Handbook*, n.d.). Besides that, as according to the federal legislation on EIA, a project is not subject to the state legislation, but to the federal legislation, if the project potentially has trans-regional impacts (Environmental impact assessment proclamation No. 299/2002). Since this is the case for the Grand Ethiopian Renaissance Dam, only the national legislation will be analyzed. The detailed analysis can be found in **Appendix C**. The results are summarized in **Tables 5 and 6**.

08. Results

The results of the analysis of the case studies of the Ivanpah Solar Power Facility and the Grand Ethiopian Renaissance Dam, and their respective legal frameworks for EIA and SIA are summarized in **Tables 3-6**. The empty cells within the tables illustrate that the legal document does not provide any guidelines and regulations for that topic.

Overall, both Ethiopia and the US, and specifically California, have extensive legislation for EIA. In both cases, the legal requirements for SIA are included within the regulations for EIA. The results of the case study analysis show that in the cases of Ethiopia and California, USA, the legal frameworks are more focussed on the assessment of environmental impacts than social impacts. This can be concluded because all questions in the analytical framework for EIA are answered, whereas several questions remain unanswered for SIA. Besides that, when looking at the social impacts that are included in the environmental assessment, following the legal framework in California, US, only social and economic impacts that are the result of environmental changes, or are the cause of environmental changes are considered. This is however not the case for the legal framework in Ethiopia.

Both legal frameworks score low in terms of the identification of social impacts for different social groups and the exploration of benefit sharing opportunities. Both topics are not at all discussed in the legislation of the US and California. They are however recognized in the legal framework in Ethiopia. The legislation states that social impacts might differ among social groups, but specific guidelines for the identification of social impacts for these social groups are not provided. In terms of benefit sharing, the Ethiopian legislation states that benefits and costs must be fairly distributed, but it is not further elaborated upon.

Accessibility of public participation to indigenous people is a topic that is specifically addressed in the US legislation, since indigenous people have a strong connection to the environment. Therefore they can provide knowledge to the public authorities and project proponents about the environment, but they are also more vulnerable to changes in the environment. However, this topic is not discussed in the

Ethiopian legislation. Ethiopian legislation does state that public participation should be inclusive and accessible for all, but it does not provide specific guidelines for indigenous people.

Both Ethiopia and California, US, perform well in terms of the exploration of alternatives, mitigation measures and monitoring obligations. Within both countries these are compulsory components of an E(S)IA report, and reports can be disapproved if this is not included.

As for the specific case studies of the Ivanpah Solar Power Facility and the Grand Ethiopian Renaissance Dam, it can be concluded that they both adhere to the legal obligations within their legislative domains. However, the analysis for the Grand Ethiopian Renaissance Dam is incomplete, due to the unavailability of the official ESIA documents.

Table 3:

Results of the analysis of the legal framework for EIA in the case of Ivanpah Solar Power Facility

The Empty cells in the table illustrate that the legal document does not provide any guidelines or regulations on the topic.

		National Environmental Policy Act 1969	**California Environmental Quality Act**	**EIS Ivanpah Solar Power Facility and Record of Decision**
Legal Obligations and Institutional Coordination	Is there a legal obligation to conduct an EIA?	EIA required for federal projects.	EIA for private and public projects, except if an EIA is already prepared by another authority under different legislation.	EIA prepared by California Energy Council and Bureau of Land Management.
	Are evaluation criteria clearly identified?		Lead agency has the responsibility of approval or demanding alterations. Decision should be based on substantial evidence	Evaluation based on legal requirements, balancing of public interests, comprehensive analysis by experts and public involvement.
Significance of Environmental Impacts	Which environmental Impacts are considered as Significant?		Significant if it causes changes in physical conditions in the area affected by the project, including land, air, water, minerals, flora, fauna, noise, and objects of historic or aesthetic importance.	The EIS considers impacts on air quality, greenhouse gas emissions, biological resources, cultural resources, hazardous materials, land use, noise and vibration, public health and safety, socioeconomics and environmental justice, soil and water resources, traffic and transportation, transmission lines, visual resources, waste management, worker safety and fire protection, geology, paleontology and minerals, livestock grazing, wild horses and Burros, recreation.
	Are secondary/indirect impacts included?		Both direct and indirect impacts should be included (with specific provisions for social and economic impacts)	For all the categories above, both direct, indirect and cumulative impacts are considered.
Public Participation	Is citizen participation legally required?	Yes, in the form of commenting on the draft report	Yes, in the form of commenting on the draft report. Public hearings are not required.	Several meetings were held: Public Scoping meeting, Informational Hearing, additional Public Scoping meeting, Issue Resolution Workshops. The Energy Commission accepted

				comments and petitions.
Mitigation and Enhancement Measures	Does the legislation require an exploration of alternatives?	Yes, technically and economically feasible alternatives should be included in the report	Alternatives that meet most project objectives and are feasible should be considered, even if they are more costly.	Alternatives for the proposed action (3 alternatives), alternatives, solar technology, other renewable technologies, and electricity conservation were considered.
	Are mitigation measures a compulsory component of the EIA report?		Project proponents and lead agencies should consider mitigation measures to reduce the impacts below significance. Mitigation measures should be feasible and target a specific impact.	The EIS mentioned 64 mitigation measures for different categories of impacts.
Monitoring and Enforcement	Is there a legal requirement for the implementation of follow-ups and monitoring?		Public agencies are responsible for monitoring, reporting or both.	There is a compliance monitoring plan, and the Bureau of Land Management is responsible.
	Does the competent authority have coercive power to ensure that the mitigation measures as proposed in the EIA are implemented?		CEQA does not provide regulatory powers, but authorizes public authorities for using already possessed powers for the purpose of CEQA.	Failure on the part of Solar Partners to adhere to the terms and conditions could result in various administrative actions up to and including suspension and termination and requirements to remove the facility and rehabilitate disturbances.

Table 4:

Results of the analysis of the legal framework for SIA in the case of Ivanpah Solar Power Facility

The Empty cells in the table illustrate that the legal document does not provide any guidelines or regulations on the topic.

		National Environmental Policy Act 1969	**California Environmental Quality Act**	**EIS Ivanpah Solar Power Facility and Record of Decision**
Legal Obligation and Institutional Coordination	Is SIA an obligatory component of EIA, or is a separate SIA required?	The consideration of social impacts is included in the legal framework for EIA.	Consideration of social impacts is included in the requirements of EIA. .	EIA, including social aspects, prepared by California Energy Council and Bureau of Land Management.

Significance of Social Impacts	Which social impacts are considered significant?	Public agencies should consider long- and short-term effects, adverse and beneficial impacts, and impacts on health and safety.	Social and economic changes are only considered when they are the effects of a physical change caused by the project, or when a physical change is the result of social and economic changes.	The EIS considers impacts on cultural resources, public health and safety, socioeconomics and environmental justice, worker safety and fire protection, recreation.
	Are social impacts identified separately for different social groups?			
Public Participation	Is public engagement legally required?	Yes, in the form of commenting on the draft report	Yes, in the form of commenting on the draft report. Public hearings are not required.	Several meetings were held: Public Scoping meeting, Informational Hearing, additional Public Scoping meeting, Issue Resolution Workshops. The Energy Commission accepted comments and petitions.
	Is participation accessible for indigenous people?		Specific guidelines for consultation with native tribes prior to the publishing of an environmental document	
Enhancement and Mitigation Measures	Is an exploration of benefit-sharing opportunities required?			Positive benefits on the local economy are considered.
	Does the legislation require exploration of alternatives?	Yes, technically and economically feasible alternatives should be included in the report	Alternatives that meet most project objectives and are feasible should be considered, even if they are more costly.	Alternatives for the proposed action (3 alternatives), alternatives, solar technology, other renewable technologies, and electricity conservation were considered.
Monitoring and Enforcement	Does a regulatory authority enforce compliance?		CEQA does not provide regulatory powers, but authorizes public authorities for using already possessed powers for the purpose of CEQA.	Failure on the part of Solar Partners to adhere to the terms and conditions could result in various administrative actions up to and including suspension and termination and requirements to remove the facility and rehabilitate disturbances.
	Is monitoring legally required?		Public agencies are responsible for monitoring, reporting or both.	There is a compliance monitoring plan, and the Bureau of Land Management is responsible.

Table 5:

Results of the analysis of the legal framework for EIA in the case of Grand Ethiopian Renaissance Dam

The Empty cells in the table illustrate that the legal document does not provide any guidelines or regulations on the topic.

		EIA proclamation No. 299/2002	**Procedural Guidelines (federal EPA)**	**IPoE GERD**
Legal Obligation and Institutional Coordination	Is there a legal obligation to conduct an EIA	EIA required if the project has (potentially) significant impacts. (Additionally, directive No. 09/2008 provides a list of categories that are subject to EIA)		GERD is subject to EIA through directive No. 09/2008 and proclamation No. 299/2002.
	Are evaluation criteria clearly identified?		Reviewing includes consideration of adequacy of compliance with ToR[1], required information, examination of alternatives, assessment of impacts, mitigation measures, monitoring, scientific and analytical techniques, and public involvement.	
Significance of Environmental Impacts	Which environmental impacts are considered as significant?	Only significant impacts on environment, social, economic or cultural conditions are considered. Significance is determined based on size, location, nature, cumulative effect, transregional effect, duration and reversibility.	Criteria for determining significance are ecological importance, social importance, environmental standards, statistical significance, and experimental findings.	The ESIA outlines beneficial and adverse impacts on the physical, biological and socio-economic environments. It includes sedimentation, water quality, and reduced dissolved oxygen because of decay of flooded vegetation.
	Are secondary/indirect impacts included?	The EIA report should include the characteristics and duration of all the estimated direct or indirect, positive and negative impacts.		
Public Participation	Is citizen participation legally required?	Environmental reports should be made available to the public for commenting.	Objective of EIA is to include popular participation in planning and decision-making on developments that may affect communities and their environment.	ESIA satisfies recommendations in terms of public consultation.
Mitigation and	Does the legislation		Basic principles of EIA is to consider	ESIA satisfies recommendations in terms

[1] Terms of Reference

Enhancement Measures	require an exploration of alternatives?		alternatives, including all feasible options to a project or its components, e.g. site, processes, raw materials, products.	of project alternatives
	Are mitigation measures a compulsory component of the EIA report?	The EIA report should at least include a description of measures proposed to eliminate, minimize, or mitigate adverse impacts.	Primary purpose of EIA is to incorporate mitigation measures for adverse significant impacts.	Environmental mitigation is discussed in the ESIA report.
Monitoring and Enforcement	Is there a legal requirement for the implementation of follow-ups and monitoring?	The EIA report should detail self-audit and monitoring procedures during implementation and operation.	Interested and affected parties are expected to follow and monitor changes and report environmental agencies.	ESIA satisfies recommendations in terms of environmental management and monitoring plan.
	Does the competent authority have coercive power to ensure that the mitigation measures as proposed in the EIA are implemented?	Federal authority may use corrective actions and order rectification measures in cases of noncompliance.		

Table 6:

Results of the analysis of the legal framework for SIA in the case of Grand Ethiopian Renaissance Dam

The Empty cells in the table illustrate that the legal document does not provide any guidelines or regulations on the topic.

		EIA proclamation No. 299/2002	**Procedural Guidelines (federal EPA)**	**IPoE GERD**
Legal Obligation and Institutional Coordination	Is SIA an obligatory component of EIA, or is a separate SIA required?	Assessment of social impacts is included in the legal framework for EIA. Environmental, social, economic and cultural impacts should be considered.	Explanatory list of environmental impacts includes socio-economic impacts.	GERD is subject to EIA, including social aspects, through directive No. 09/2008 and proclamation No. 299/2002.
Significance of Social Impacts	Which social impacts are considered as significant?		Description of socio-economic impacts: e.g. deterioration of living and working conditions, resettlement and cultural shock,	Adverse impacts on the local population, household and livelihood assets, public infrastructure, and social services are

			risks to health and safety, variation in impacts between different social groups, changes of rights to land and natural resources, social changes caused by in-migration.	considered.
	Are social impacts identified separately for different social groups?		Recognition that social impacts might differ for different social groups, but no legally binding guidelines.	
Public Participation	Is public engagement legally required?	Environmental reports should be made available to the public for commenting.	Objective of EIA is to include popular participation in planning and decision-making on developments that may affect communities and their environment.	ESIA satisfies recommendations in terms of public consultation.
	Is participation accessible for indigenous people?		Participation should be appropriate and accessible to all interested and affected parties.	
Enhancement and Mitigation Measures	Is an exploration of benefit-sharing opportunities required?		EIA should ensure a fair distribution of costs and benefits.	
	Does the legislation require exploration of alternatives?		Basic principles of EIA is to consider alternatives, including all feasible options to a project or its components, e.g. site, processes, raw materials, products.	ESIA satisfies recommendations in terms of project alternatives/
Monitoring and Enforcement	Does a regulatory authority enforce compliance?	Federal authority may use corrective actions and order rectification measures in cases of noncompliance.		
	Is monitoring legally required?	The EIA report should detail self-audit and monitoring procedures during implementation and operation.	Interested and affected parties are expected to follow and monitor changes and report environmental agencies.	ESIA satisfies recommendations in terms of environmental management and monitoring plan.

09. Discussion

In the following section, the results presented in the previous section will be interpreted and integrated with existing literature. This section will contribute to a better understanding of the results and how these relate to the effectiveness of the legal frameworks in preventing and mitigating socio-environmental impacts from large-scale infrastructure projects.

The main results of this study can largely be related to a debate about whether conducting an environmental and social impact assessment should be a separated or integrated process. Especially the legal framework in the USA and California, shows that the framework focussed primarily on environmental impacts, and that social impacts are only considered to be significant if they are the cause or direct consequence of an environmental change. However, this framework is also the only one that can act as a legal basis for SIA. The legal framework in Ethiopia, by contrast, defines environmental impacts in a broader manner, including socio-economic impacts. In both the USA and Ethiopia, several components that are defined as good practices of SIA in the literature are missing in the legal frameworks.

First of all, there is a general consensus that the impacts of a large-scale infrastructure project do not affect social groups in the same manner and to the same extent. The effects on women, poor populations, indigenous people, and other vulnerable groups, can widely vary. Therefore, the affected community should not be considered a homogenous group, but as separate entities which are affected differently. Secondly, neither of the legal frameworks explicitly mentions a requirement for an exploration of benefit-sharing opportunities. Benefit sharing could be supporting a certain project in exchange for specific benefits such as royalties, payments, employment, social investments in the community, etc. (Vanclay et al., 2015). Benefit sharing also reduces the resistance towards a project and lessens the likelihood of disruption, renegotiation and expropriation (Muigua et al., 2019). Thirdly, the role of indigenous people is sparsely discussed in the legal framework. In the USA framework, there are specific guidelines for participation of indigenous people. It is highlighted that indigenous peoples are more closely related to their environment, and therefore they have valuable knowledge about it, and they are more vulnerable to any changes. In contrast to the Ethiopian legal framework, where this is not included.

To conclude, in both the legal frameworks that are analyzed in this study the social impact assessments are not sufficiently incorporated into the legal frameworks for environmental impact assessments. There is no other legal basis for social impact assessment to make up for this deficiency. Nevertheless, the conclusion that social impacts are not adequately addressed in environmental impact assessments is not new. According to Freudenburg (1986) and Ogorodnikova (2024), this is the exact reason why procedures for separate social impact assessment started developing. The supporting argument for separate procedures is that environmental impacts cannot be prioritized over social impacts when they are assessed in separate procedures (Dendena & Corsi, 2015). Besides that, social and environmental impacts are measured in different ways. Environmental impacts are measured without people's experiences in mind, whereas social impacts are assessed as how they are perceived by people (De Groot, 2017; Vanclay, 2020). However, there are also quantitative approaches to measuring social impacts, such as health statistics and employment rates (*Social Impact Metrics Guide | Sopact*, n.d.).

The goal of separating EIA and SIA processes is to ensure that social impacts are not considered as subordinate to environmental impacts. However, according to Dendena and Corsi (2015), the separation of the processes still results in SIA being subordinate to EIA. Therefore efforts have been taken to integrate EIA and SIA into one singular process, Environmental and Social Impact Assessments (ESIA), in which both have equal weight. The supporting argument for this is that social and environmental impacts are interrelated. In this context, Becker and Vanclay (2003) have introduced the concept of human impacts. They argue that all impacts are human impacts, but there are different pathways in which they arise. Some impacts are caused by changes in the social setting, and some are caused by changes in the environment. They argue that because of this, EIA and SIA cannot be fully separated. Vanclay (2006) also states that some social impacts are caused by environmental changes, and that some environmental impacts are caused by social changes.

The U.S. and Californian legal frameworks inclusion of social and economic impacts has some resemblance to reasoning used by Vanclay and Becker (2003). Within the legal frameworks, social impacts are only considered significant if they are the direct cause or consequence of physical changes in

the environment. In practice, this means that any social impact that is not related to any environmental change, is not included in the analysis. Additionally, defining social and environmental impacts as human impacts is a human centered approach. It insinuates that any impact caused by a project would only matter if they eventually impact humans. The same stance can be observed in the National Environmental Policy Act (1969) in the USA. Within this legal document, the environment is repetitively referred to as ‘mankind's environment’. Both these instances reflect that human interests override environmental values.

At the core, the arguments for integrating social and environmental impact assessment, are stronger than those for having two separate processes. The main argument for having two separate processes is to prevent social impacts from being perceived as subordinate to environmental impacts. The main argument for having one singular process is the interconnectedness of social and environmental aspects, and the inability to fully separate those. The latter argument reflects a core principle of socio-environmental systems, whereas the first argument targets an inadequate framework in which social and environmental impacts are not given equal importance. Perhaps this is not per se an issue of SIA and EIA, but a broader issue in which social aspects are not given equal legitimacy because of the predominantly qualitative ways in which these are measured, in contrast to the quantitative measurements for environmental aspects. However, the legal frameworks for EIA and SIA can be adapted to guarantee an equal consideration of both social and environmental aspects.

The inclusion of social impacts in EIA starts with the definition of environmental impacts. For example, the definition of environmental impacts that is used in the Ethiopian legal framework for EIA directly includes socio-economic impacts, in contrast to the US definition, where the social and economic impacts are merely a footnote. In order to transition towards a singular legal framework to assess both social and environmental impacts, the definition of environmental impacts would have to be adapted. Additionally, legal requirements for components of SIA, such as identifying social impacts for different social groups separately, requirements for the participation of indigenous people, and requirements for exploring benefit-sharing opportunities, have to be included.

10. Conclusion

The objective of this research is to analyze the capability of existing legal frameworks for Environmental Impact Assessments (EIA) and Social Impact Assessments (SIA) in preventing and mitigating the socio-environmental impacts or large-scale infrastructure projects. Two case studies, the Ivanpah Solar Power Facility and the Grand Ethiopian Renaissance Dam, were analyzed, and it was found that social impacts were not adequately addressed within the EIA, as no separate legal basis for SIA existed. These findings align with the ongoing debate within academic literature about whether social impacts should be assessed separately from environmental impacts, or as a singular, integrated process.

The findings underline the inadequacy of current legal frameworks to incorporate social aspects within environmental impact assessments. Adaptations are needed to include social impacts sufficiently within the legal frameworks for EIA, to transition towards legal frameworks for Environmental and Social Impact Assessment (ESIA). This would include adapting the definition used in legal documents for environmental impacts, to a broader definition that included socio-economic impacts as well. Besides that, legal obligations and guidelines should be formulated to include crucial components of SIA, such as identification of social impacts for different social groups separately, ensuring participation of indigenous people, and exploring opportunities for benefit-sharing.

The research has several limitations. First of all, the analysis of the case studies is incomplete. This is because of the extensiveness of the analytical framework, of which only the most significant factors are considered within this research because of manageability. Further research is needed to also include the factors that are not analyzed in this study, such as the objectivity and independence of practitioners, different stages and forms of public participation, and information disclosure, to create a more comprehensive understanding of the legal frameworks. Additionally, the accessibility of certain documents resulted in constraints in the depth of the analysis of the case studies. Secondly, this research only considered two case studies, which limit the generalizability of the findings. For a more thorough and validated finding, the research would need to be expanded to include more case studies.

In conclusion, improvements and adaptations are needed to integrate social impact assessments into environmental impact assessment, which is crucial for effectively mitigating the socio-environmental impacts of large-scale infrastructure projects. Further research is needed to identify the adaptations that are needed and effective approaches. Continued research and refining the legal frameworks can lead to more sustainable development practices in the future.

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Appendix A

Table 1: *Analytical framework derived from the literature review*

Environmental Impact Assessment		**Sources**
Legal obligation and institutional coordination	Is there a legal obligation to conduct an Environmental Impact Assessment?	Ogola, 2007; Stookes, 2003
	Are practitioners of EIA objective and independent?	Robinson, 1992; Zhang et al., 2013;
	Is the review body objective and independent?	Robinson, 1992; Zhang et al., 2013
	Are evaluation criteria clearly identified?	Stookes, 2003
Consideration and significance of Environmental Impacts	Which Environmental Impacts are considered as significant?	Duinker & Beanlands, 1986; Glasson, 2008; Staerdahl, 2004;
	Is there a clearly defined screening threshold within the legislation?	Stookes, 2003
	Are secondary or indirect impacts included besides the direct environmental impacts?	Glasson, 2008; Staerdahl, 2004
	How is the significance of an impact determined?	Duinker & Beanlands, 1986; Andrews et al., 1977; Glasson, 2008
Public engagement	Is citizen participation legally required?	Stookes, 2003; Zhang et al., 2013
	In what stages of the EIA process is citizen participation included?	Stookes, 2003; Zhang et al., 2013
	Is public participation inclusive and accessible?	Stookes, 2003; Zhang et al., 2013
Mitigation and enhancement measures	Does the legislation require exploration of alternatives to minimize environmental impacts?	Zhang et al., 2013
	Are mitigation plans a compulsory component of the EIA report?	Arts et al., 2001; Loomis and Dziedzic, 2018; Zhang et al., 2013
Monitoring and enforcement	Is there a legal requirement for the implementation of follow-ups and monitoring systems?	Loomis and Dziedzic, 2018
	Does the competent authority have coercive power to ensure that the mitigation measures as proposed in the EIA report will be implemented?	Arts et al., 2001
	Is monitoring information freely accessible, and can the local community make complaints/comments?	Arts et al., 2001
Social Impact Assessment		
Legal obligation and institutional coordination	Is social impact assessment an obligatory component of the Environmental Impact Assessment, or is a separate Social Impact Assessment required?	Freudenburg, 1986; Ogorodnikova et al., 2024;
	Are authorities and their responsibilities clearly defined?	Ogorodnikova et al., 2024; Takyi, 2014; Vanclay et al., 2015

	Are the practitioners of SIA independent, influential and competent?	Howitt, 2011; Lockie, 2001; Kemp, 2011; Ogorodnikova et al., 2024; Takyi, 2014; Vanclay et al., 2015; Vanclay, 2006
Consideration and significance of social issues	What does the term social impacts entail, and how is it measured?	Ogorodnikova et al., 2024; Vanclay, 2006
	Does the legal framework require a screening procedure to determine the if and what level of SIA is to be applied?	Esteves et al., 2012; Kemp, 2011; Ogorodnikova et al., 2024;
	Are social impacts identified for vulnerable groups, such as indigenous people, women, and the poor?	Dani, 2003; Esteves et al., 2012; Lockie, 2001; Ogorodnikova et al., 2024;
	How is the significance of social impacts determined?	Esteves et al., 2012; Kemp, 2011; Vanclay et al., 2015
	Is the collection of baseline data a legal requirement?	Esteves et al., 2012
Public engagement	Is public engagement legally required?	Howitt, 2011; Ogorodnikova et al., 2024; Takyi, 2014
	At what phase is public engagement implemented and in what form?	Dani, 2003; Lockie, 2001; Takyi, 2014; Vanclay and Esteves, 2011;
	Is participation accessible for indigenous people?	Lockie, 2001; Vanclay et al., 2015;
	Are there legal requirements for disclosure of information?	Ogorodnikova et al., 2024; Takyi, 2014; Vanclay et al., 2015;
	Is information made public and in an accessible manner?	Ogorodnikova et al., 2024; Takyi, 2014; Vanclay et al., 2015;
Mitigation and enhancement measures	Is an exploration of benefit-sharing opportunities required?	Esteves et al., 2012; Ogorodnikova et al., 2024; Vanclay and Esteves, 2011
	Does the legislation require exploration of alternatives?	Esteves et al., 2012; Vanclay et al., 2015;
	Are social impact management plans required?	Kemp, 2011; Ogorodnikova et al., 2024; Takyi, 2014; Vanclay and Esteves, 2011; Vanclay, 2006
	Are emergency preparedness plans required?	Ogorodnikova et al., 2024
Monitoring and enforcement	Does a regulatory agency enforce compliance?	Esteves et al., 2012; Lockie, 2001; Ogorodnikova et al., 2024; Takyi, 2014
	Is monitoring legally required?	Esteves et al., 2012; Lockie, 2001; Ogorodnikova et al., 2024; Takyi, 2014

Appendix B

Environmental Impact Assessment

In this section the legal requirements for Environmental Impact Assessments in California, US, will be evaluated in light of the Ivanpah Solar Power Facility. The analysis is done on the basis of the analytical framework. The framework contains a set of questions divided into five categories, and these are answered below. The results are compactly summarized in **table 3**.

Legal Obligations and Institutional Coordination

Is there a legal obligation to conduct an EIA? There is a legal obligation to conduct an Environmental Impact Assessment (EIA) under certain conditions. The National Environmental Policy Act of 1969 (NEPA), last amended in 2023, requires federal agencies to consider environmental factors by preparing an environmental statement for federal projects, which are those undertaken or funded by federal agencies (Federal Project Definition | Law Insider, n.d.). Exceptions include projects that are not final agency actions or those categorically exempt due to insignificant environmental impact (Judicial Review of Agency Action - Acus Wiki, n.d.).

In California, the California Environmental Quality Act (CEQA) of 1970 mandates environmental reviews for private and public projects, defining a project as any activity causing direct or foreseeable indirect environmental changes. CEQA exemptions include thermal power projects if an environmental document is prepared under a certified regulatory program. The California Energy Commission (CEC) has exclusive authority to license thermal power plants over 50 MW, and its environmental documents override other regulatory requirements (California Energy Commission, n.d.). Thus, the Ivanpah Solar Power Facility is certified by the CEC.

Are evaluation criteria clearly identified? The lead agency is responsible for determining if a project is subject to CEQA and is not exempt from it. Through an initial study, the lead agency determines

whether the proposed project has the potential to have a significant effect on the environment. The degree of significance determines whether an Environmental Impact Report is required, or whether a (Mitigated) Negative Declaration is issued. Significant effect on the environment is defined in §21068 as a substantial, or potentially substantial, adverse change in the environment. The lead agency determines whether a project has a significant effect on the environment based on substantial evidence, those include facts, reasonable assumptions based on facts, and expert opinion supported by facts. §21083 prescribes that the Office of Planning and Research is responsible for developing guidelines for the implementation of the act, which include criteria for public agencies to determine whether a proposed project could have a significant impact on the environment. This is the case when one or more of the following criteria are true:

- The proposed project has the potential to degrade the quality of the environment to achieve short-term goals, over long-term environmental goals.
- The possible effects of the project alone are limited, but in combination with the effects of projects in the past, other current projects, and possible projects in the future, are significant.
- The environmental effects will cause negative effects on human beings.

If an environmental document is prepared, the lead agency is responsible for approving it or demanding alterations. The lead agency is required to balance benefits and adverse effects, and make a decision based on the evidence. For every decision made by the lead agency, they have to provide a justification for the decision. (Sections: 15093, 15091)

Consideration and Significance of Impacts

Which environmental impacts are considered as significant? Within NEPA, the significance of the environmental impacts is the determinant of whether an environmental impact statement is required or not. However, the legislation does not provide a determination of when an impact is considered as significant or not. CEQA, on the other hand, does provide some guidelines to determine the significance

of environmental effects. §15382 defines a significant impact on the environment as a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project, including land, air, water, minerals, flora, fauna, ambient noise, and objects of historic or aesthetic significance. This provision also includes a clarification on the significance of social and economic impacts, which on its own is not considered as a significant effect on the environment, but a social or economic change related to a physical change might be considered as significant. §15064.3-5 elaborates specifically on the significance of transportation impacts, impacts from greenhouse gas emissions, and impacts on historical or archaeological resources.

Are secondary or indirect impacts included? As prescribed in §15064, when evaluating the significance of impacts, the lead agency has to include direct physical changes caused by and immediately related to the project, such as dust, noise, and odors, indirect physical change that is not immediately related to the projects but is caused indirectly by it. For example how population growth leads to more air pollution. Indirect changes are only considered if they are reasonably foreseeable, so they cannot be speculative or unlikely to occur.

Social and economic changes are only considered when they are the adverse effects of a physical change caused by the project, or when a physical change is the result of social and economic changes. Social and economic changes can also be used to indicate that a physical change is significant.

Public Engagement

Is citizen participation legally required? Both NEPA and CEQA require all public agencies that are preparing an environmental document, to request comments from the public on impacts, alternatives, relevant information and the analysis. §15044 of CEQA describes the authority to comment, and any person or entity that is not a responsible agency can submit comments concerning any environmental

impact of a proposed project. Besides this, public agencies themselves are obligated to develop procedures and guidelines for public participation during the CEQA process, as according to §15201.

Another form of public participation, public hearings, are not required during any stage of the Environmental Impact Assessment process. However, if an agency decides to do a public hearing, the environmental review must be discussed. §15202 does prescribe that public hearings should be held when the lead agency deems it beneficial for the CEQA purposes.

Mitigation and Enhancement Measures

Is exploration of alternatives legally required? Following NEPA, feasible alternatives are a compulsory component of environmental impact reports. The alternatives proposed have to be technically and economically feasible. CEQA is intended to assist public agencies to systematically identify significant effects and feasible alternatives, as well as mitigation measures to eliminate or substantially reduce the environmental impacts. The alternatives proposed in the environmental document have to be feasible and meet most of the project objectives. The lead agency is responsible for determining which alternatives will be considered, and they have to explain their rationale. Alternatives that are more costly should still be considered. §15126.6 states that alternatives should only be proposed for effects on the environment that are significant. §15021 prescribes that a lead agency should not approve a project if there are feasible alternatives that would reduce the environmental impact.

Are mitigation measures a compulsory component of the EIA report? Within NEPA, mitigation measures are not discussed. Within CEQA, both the project proponents and the lead agency are required to consider mitigation measures to reduce the environmental impact to a below significant level. Mitigation involves avoiding or minimizing impacts, rectifying the impact through repair or restoration, reducing or eliminating the impact over time through preservation and maintenance operations, and compensating for the impact by replacing or providing substitute resources or environments. Lead

agencies have the authority to demand changes in a project proposal to include mitigation measures. Similarly to the exploration of alternatives, the proposed mitigation measures should be feasible, and they should be connected to the specific significant environmental impact.

Monitoring and Enforcement

Is there a legal requirement for monitoring and follow-ups? According to §15097 of CEQA, public agencies are responsible for adopting a program for monitoring and reporting, in order to ensure that the mitigation measures and project revisions identified in the environmental document are implemented. The public agency can choose to opt for either monitoring, reporting, or both, based on what they deem most suitable to the project. Neither NEPA or CEQA identify procedures for local communities and individuals to make complaints or comments after the approval of the environmental document.

Does the competent authority have coercive power to ensure compliance? Enforcement of the agreements made in the environmental document, as well as compliance with the process itself, is not discussed in NEPA. According to §15040, CEQA does not provide public agencies with regulatory powers. It does however supplement the discretionary powers that public agencies already possess by authorizing them to use those powers for the purposes of mitigating environmental impacts. In CEQA litigation cases where public agencies do not comply with CEQA standards and procedures, courts can rely on remedies such as issuing a peremptory writ of mandate, requiring the agency to void project approval and suspending activities, according to §15234. This only applies in instances where the project proponent is sued.

Social Impact Assessment

In this section the legal requirements for Social Impact Assessments in California, US, will be evaluated in light of the Ivanpah Solar Power Facility. The analysis is done on the basis of the analytical framework. The framework contains a set of questions divided into five categories, and these are answered below. The results are compactly summarized in **table 4**.

Legal Obligations and Institutional Coordination

Is SIA an obligatory component of the EIA, or is a separate SIA required? Whereas there is a specific legal act in the United States that functions as a legal basis for the obligation for the environmental impact assessment, namely NEPA, there is not a specific act for social impact assessments. The consideration of social effects of a project is included within the environmental impact assessment. Section 101 (a) of NEPA states that the significant impact of human activities on the environment, particularly due to population growth, urbanization, industrialization, resource exploitation, etc., is recognized, and that maintaining environmental quality is important for societal welfare. Therefore, the state, local agencies and organizations should do everything within their power to foster conditions in which humans and nature can coexist productively. The Code of Federal Regulations on the implementation of NEPA, in section 1508.1 defines effects as ecological, aesthetic, historic, cultural, economic, social, or health, whether direct, indirect, or cumulative.

The same is true for state level: the consideration of social impacts of projects in California is included in the requirements of CEQA. Chapter 1 of CEQA explains the legislative intent, which also underlines the interconnectedness of environmental quality and human welfare, and the importance of productive coexistence.

In some cases, public agencies have their own standards and guidelines for social impact assessments. However this is not the case for the California Energy Commission, nor the Bureau of Land Management, which are the public agencies responsible for the environmental impact assessment of the Ivanpah Solar Power Facility.

Consideration and Significance of Impacts

Which social impacts are considered as significant? According to NEPA, as well as the regulations for implementing NEPA, the environmental impact report should only include significant impacts. Public agencies have to determine the significance of impacts based on the specific context of the project, and they should consider both long- and short-term effects, adverse and beneficial impacts, and effects on public health and safety (section 1501.3).

CEQA §15382 defines a significant impact on the environment as a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project, including land, air, water, minerals, flora, fauna, ambient noise, and objects of historic or aesthetic significance. However, this definition does not mention social impacts. §15064 states that social and economic changes are only considered when they are the adverse effects of a physical change caused by the project, or when a physical change is the result of social and economic changes. Social and economic changes can also be used to indicate that a physical change is significant.

The lead agency has the discretion to determine whether qualitative, quantitative, or both methods will be used. The lead agency is expected to choose the method that is most suitable for the purpose, also considering the availability of data. The final determination of whether an effect is significant has to be based on substantial evidence. If there is no clear evidence, but there is disagreement among expert opinion, the lead agency has to assume that the effects are significant and prepare an environmental impact statement or report.

Are social impacts identified separately for different social groups? NEPA and the regulations for implementing NEPA, do not prescribe any guidelines for consideration of social impacts, and it does not recognize that impacts of a project might differ for particular social groups such as indigenous people, women, and economically disadvantaged people.

CEQA does include some specific provisions aimed at tribal resources and specific guidelines for participation of indigenous peoples. However, it does not prescribe public agencies to determine the impact of a project separately for other vulnerable social groups.

Public Engagement

Is citizen participation legally required? NEPA requires all public agencies that are preparing an environmental document, to request comments from the public on impacts, alternatives, relevant information and the analysis. CEQA also requires comments from public and public agencies on draft environmental documents. §15044 describes the authority to comment, and any person or entity that is not a responsible agency can submit comments concerning any environmental impact of a proposed project. Besides this, public agencies themselves are obligated to develop procedures and guidelines for public participation during the CEQA process, as according to §15201.

Another form of public participation, public hearings, are not required during any stage of the Environmental Impact Assessment process. However, if an agency decides to do a public hearing, the environmental review must be discussed. §15202 does prescribe that public hearings should be held when the lead agency deems it beneficial for the CEQA purposes.

Is participation accessible for indigenous people? According to CEQA, public hearings are not an obligation for lead agencies, but if public hearings are organized, the lead agency can opt for a location that they frequently use for public hearings, or a location that is convenient and accessible to the public. All persons and public agencies (except for responsible agencies), organizations and corporations have the right to participate, but the legislation does not include provisions to enhance the inclusivity of specific social groups.

Since native tribes generally have more affiliation with a geographical area they can provide important information and insights into the impacts a proposed project might have on the land. Therefore,

§ 21080.3.1 of CEQA prescribes specific guidelines for consultation with native tribes prior to the publishing of an environmental document.

Mitigation and Enhancement Measures

Is an exploration of benefit sharing opportunities required? Both NEPA and CEQA are primarily focused on environmental impacts, where social impacts are considered as secondary impacts of environmental impacts, or the cause of environmental impacts. Benefit-sharing is a concept that is only relevant to mitigate negative social changes. This is in neither of the legal documents discussed.

Does the legislation require exploration of alternatives? Following NEPA, feasible alternatives are a compulsory component of environmental impact reports. The alternatives proposed have to be technically and economically feasible. CEQA is intended to assist public agencies to systematically identify significant effects and feasible alternatives, as well as mitigation measures to eliminate or substantially reduce the environmental impacts. The alternatives proposed in the environmental document have to be feasible and meet most of the project objectives. The lead agency is responsible for determining which alternatives will be considered, and they have to explain their rationale. Alternatives that are more costly should still be considered. §15126.6 states that alternatives should only be proposed for effects on the environment that are significant. §15021 prescribes that a lead agency should not approve a project if there are feasible alternatives that would reduce the environmental impact.

Monitoring and Enforcement

Does a regulatory authority enforce compliance? Enforcement of the agreements made in the environmental document, as well as compliance with the process itself, is not discussed in NEPA. According to §15040, CEQA does not grant regulatory powers to public agencies. However, it

supplements the discretionary powers that public agencies already possess by authorizing them to use those powers to mitigate environmental impacts. In CEQA litigation cases where public agencies do not comply with CEQA standards and procedures, courts can issue a peremptory writ of mandate, requiring the agency to void project approval and suspend activities, according to §15234.

Is monitoring legally required? According to §15097 of CEQA, public agencies are responsible for adopting a program to monitor and report on the implementation of mitigation measures and project revisions identified in the environmental document. The public agency can choose monitoring, reporting, or both, depending on what best suits the project. Neither NEPA nor CEQA specify procedures for local communities and individuals to make complaints or comments after the environmental document is approved.

Appendix C

Environmental Impact Assessment

In this section the legal requirements for Environmental Impact Assessments in Ethiopia, will be evaluated in light of the Grand Ethiopian Renaissance Dam. The analysis is done on the basis of the analytical framework. The framework contains a set of questions divided into five categories, and these are answered below. The results are compactly summarized in **table 5**.

Legal Obligations and Institutional Coordination

Is There a Legal Obligation to Conduct an EIA? In Ethiopia, EIA is legally obligated by the Environmental Impact Assessment Proclamation No. 299/2002. A complete environmental impact assessment is only required if the initial assessment shows (potentially) significant environmental effects. Next to an EIA, a Trans-Regional Impact Assessment is required, which includes consultations with the other impacted regions. This is the case for GERD.

Directive No. 09/2008 is an addition to the EIA proclamation No. 299/2002 and determines the categories of projects that are subject to an Environmental Impact Assessment. It states that dams and reservoir construction require an EIA if the dam height is more than 15 meter, the reservoir storage capacity is more than 3 million mm3, or it has more than 10 Megawatt power generation capacity. All three criteria are true in the case of GERD.

Are Evaluation Criteria Clearly Identified? The federal environmental protection authority or the regional environmental agency is responsible for evaluating and (not) approving environmental impact studies. They have the option to approve without conditions, approve with conditions to mitigate or reduce the adverse impacts or to refuse implementation of the project. However, the national legislation (proclamation No. 299/2002) does not provide guidelines for how this should be determined. The federal Environmental Protection Authority has published procedural guidelines for EIA. These are legally

binding as they have legal basis in proclamation No. 299/2002. The procedural guidelines state that reviewing may include considerations of adequacy of compliance with the Terms of Reference, required information, examination of alternatives, assessment of impacts, appropriateness of mitigation measures and monitoring schemes, the use of scientific and analytical techniques, and the extent of public involvement.

Consideration and Significance of Impacts

Which Environmental Impacts are Considered as Significant? Proclamation N0. 299/2002 defines an impact as any change to the environment or to its component that may affect human health or safety, flora, fauna, soil, air, water, climate, natural or cultural heritage, other physical structure, or in general, subsequently alter environmental, social, economic or cultural conditions. The impact should be assessed on the basis of the size, location, nature, cumulative effect with other concurrent impacts of phenomena, transregional effect, duration, reversibility or irreversibility or other related effects of the project. In case of uncertainty, the responsible authority should be cautious and consider an impact as significant. The procedural guidelines of the federal Environmental Protection Authority state that the criteria for determining the significance of an impact are the ecological importance, the social importance, environmental standards, statistical significance and experimental findings.

Are Secondary of Indirect Impacts Included Besides the Direct Environmental Impacts? Proclamation No. 299/2002 defines the environment as the totality of all materials whether in their natural state or modified or changed by humans, including their interactions that affect the quality or quantity and the welfare of humans or other living beings. This does not specifically state that indirect impacts are considered, but the use of the word ‘interactions’ could imply that secondary or indirect effects are included. Furtheron in the proclamation it is stated that an environmental study report should at a

minimum contain the characteristics and duration of all the estimated direct or indirect, positive and negative impacts.

Public Engagement

Is public engagement legally required? The procedural guidelines of the federal EPA states that one of the objectives of an EIA is to include popular participation in planning and decision making on developments that may affect the communities and their environment. Proclamation No. 299/2002 states that the authority must make any environmental study report available to the public for commenting, that the comments should be reviewed, and incorporated into the environmental impact study report as well as in its evaluation. The procedural guidelines also state that a description of the participation process should be included in the annexes to the rapport.

Mitigation and Enhancement Measures

Does the legislation require exploration of alternatives to minimize environmental impacts? The proclamation No. 299/2002 itself does not require an exploration of alternatives. The procedural guidelines of the federal EPA does however state that one of the basic principles of EIA is to consider alternatives, including all feasible options to a project or its components like site, processes, products, raw materials, etc.. The exploration of alternatives should already start during the scoping phase of the EIA and should be included in the scoping report. The EIA should compare all feasible alternatives, and the reviewing of the report should consider the adequacy of this.

Are mitigation plans a compulsory component of the EIA report? The procedural guidelines of the federal EPA states that the primary purpose of an environmental assessment is to ensure that impacts of a project are adequately and appropriately considered and mitigation measures for adverse

significant impacts are incorporated when decisions are taken. Proclamation No. 299/2002 states that an EIA report should at least include a description of measures proposed to eliminate, minimize, or mitigate negative impacts. It is the responsibility of the federal authority or the relevant regional environmental agency to approve a project's environmental report with conditions to eliminate or reduce environmental impacts, or without.

Monitoring and Enforcement

Is there a legal requirement for the implementation of follow-ups and monitoring systems? Proclamation No. 299/2002 states that an environmental impact study report should detail self-audit and monitoring procedures during implementation and operation. The federal authority or the relevant regional environmental protection agency is responsible for the monitoring of the implementation. According to the procedural guidelines of the federal EPA, the project proponent is responsible for the implementation of environmental units that monitor the environmental performance, and interested and affected parties are expected to follow and monitor changes and inform the environmental agencies.

Does the competent authority have coercive power to ensure that the mitigation measures proposed in the EIA report will be implemented? Proclamation No. 299/2002 states that the Authority or regional environmental agency must monitor an authorized project to ensure compliance with commitments and obligations. If the project fails to comply, the Authority may order rectification measures. Other agencies may suspend or cancel authorizations or licenses. The proclamation also states that any non-compliance with the proclamation is an offense and is thus liable. The enforcement method prescribed is fines and an obligation to restore or compensate for the damage that was inflicted. Proclamation No. 295/2002 on the establishment of environmental protection organs placed the authority to enforce implementation on the Environmental Protection Authority.

Social Impact Assessment

In this section the legal requirements for Social Impact Assessments in Ethiopia, will be evaluated in light of the Grand Ethiopian Renaissance Dam. The analysis is done on the basis of the analytical framework. The framework contains a set of questions divided into five categories, and these are answered below. The results are compactly summarized in table 6.

Legal Obligations and Institutional Coordination

Is social impact assessment an obligatory component of the EIA, or is a separate SIA required? In the Federal Democratic Republic of Ethiopia, there is no specific legal proclamation that proscribes a legal obligation to conduct a Social Impact Assessment. However, the assessment of social impacts is included in the legal framework for Environmental Impact Assessment. Therefore, proclamation No. 299/2002 states that EIA should harmonize and integrate environmental, economic, cultural and social considerations into decision making. Impact is also defined including alterations to environmental, social, economic and cultural conditions. The procedural guidelines of the federal EPA provides an explanatory list of environmental impacts, which includes socio-economic impacts.

Consideration and Significance of Impacts

Are social impacts identified for vulnerable groups, such as indigenous people, women, and the poor? The procedural guidelines of the federal EPA does recognize that impacts might differ for social groups, including men and women. However, in neither this document nor Proclamation No. 299/2002 is there a legally binding guideline to consider the social impacts specifically for those different social groups.

What social impacts are considered as significant? Proclamation No. 299/2002 defines an impact including alterations to environmental, social, economic or cultural conditions. The significance is determined based on the size, location, nature, cumulative effect with other impacts or phenomena, transregional effect, duration, and reversibility. The procedural guidelines state that impact significance guidelines include ecological importance, social importance, environmental standards, statistical significance and experimental findings. It also includes a description of socio-economic impacts, such as deterioration of living and working conditions, resettlement and cultural shock, risk to health and safety, variation in impacts between social groups, changes of rights to land and natural resources, and social changes caused by in-migration.

Public Engagement

Is public engagement legally required? One of the primary objectives of an EIA, according to federal EPA procedural guidelines, is to involve the public in planning and decision-making regarding developments that may have an impact on local communities and their environment. According to Proclamation No. 299/2002, the authority is required to provide any environmental study report for public comment. The comments will then be examined, considered, and included in both the environmental impact study report and its evaluation. An explanation of the participation process must be included in the rapport's annexes, according to the procedural guidelines.

Is participation accessible for Indigenous people? The procedural guidelines of the federal EPA state that participation should be appropriate and accessible for all interested and affected parties, as well as transparent. However, neither this document nor proclamation No. 299/2002 provide any guidelines of how this is ensured, nor specific guidelines for indigenous people.

Mitigation and Enhancement Measures

Is an exploration of benefit-sharing opportunities required? Benefits are in both the proclamation No. 299/2002 and the procedural guidelines mainly discussed in the light of maximizing the benefits and minimizing the adverse impacts. The procedural guidelines also state that equity is one of the core values and that the EIA should ensure a fair distribution of costs and benefits. However, there are no further legally binding statements about benefit sharing.

Does the legislation require exploration of alternatives? An investigation of alternatives is not necessary in light of Proclamation No. 299/2002 itself. Nonetheless, one of the fundamental principles of an environmental impact assessment (EIA) is to take into account all realistic alternatives to a project or any of its components, such as the site, procedures, products, raw materials, etc., according to the federal EPA's procedural guidelines. The scoping report should include the results of the alternative exploration, which should have been started during the EIA's scoping phase. All feasible alternatives should be compared in the EIA, and the adequacy of this should be considered when evaluating the report.

Monitoring and Enforcement

Does a regulatory agency enforce compliance? According to Proclamation No. 299/2002, an authorized project must be monitored by the Authority or a regional environmental agency to make sure that all commitments and obligations are being met. The Authority has the authority to impose corrective actions if the project doesn't comply. Authorizations and licenses may be revoked or suspended by other agencies. The proclamation also states that non-compliance is an offense and carries consequences. Fines and a duty to compensate or restore for any damage caused are the recommended methods of enforcement. The Environmental Protection Authority was given the authority to enforce implementation by Proclamation No. 295/2002, which established environmental protection organs.

Is monitoring legally required? An environmental impact study report must include details about self-audit and monitoring protocols during implementation and operation, according to Proclamation No. 299/2002. The authority responsible for monitoring the implementation is either the federal Environmental Protection Agency or the appropriate regional environmental protection agency. The project proponent has the responsibility for implementing environmental units in place to monitor environmental performance, and interested and affected parties are expected to follow and monitor changes and notify the environmental agencies, as per the federal EPA's procedural guideline