COLLEGE OF DEVELOPMENT STUDIES

CENTER FOR ENVIRONMENT AND DEVELOPMENT

POST-PROJECT ENVIRONMENTAL EFFECT AND ITS RESTORATION PRACTICE OF HYDROPOWER PROJECT CONSTRUCTION SITES: THE CASE OF GIBE III HYDROPOWER PROJECT SITE

By

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Declaration

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ACRONYMS

EEP- Ethiopia Environment policy

EMS- Environmental Management System

EPA- Environment Protection Authority

ESIA- Environmental and Social Impact Assessment

GOE- Government of Ethiopia

GPS- Global Positioning System

HEP- Hydroelectric Power

RII- Relative Importance Index

SNNPR- Southern Nation and Nationalities and Peoples Region

WCED- World Center for Environment and Development

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Abstract

Environmental issues are becoming a global agenda demanding integrative approach, while planning and implementing development projects regardless of their type, size and scope in any country. The purpose of this study was identifying the post-project environmental effect of construction and restoration activities in "GIBE III Hydroelectric Dam Project" site. To this end, the exploratory survey research design was employed. Samples of 112 households were selected representing residents around the project area for survey questionnaire. For interview purpose, top community elders, coordinators and management staffs in the Ethiopian Electric Power Corporation Project Offices were selected purposively. Self-developed questionnaire was used for the collection of quantitative data which assesses the impact and restoration practice. It includes five items designed to assess the impact on ecosystem, natural resource, and public health in the study area. The study used relative importance index as analytical tool. On the other hand, qualitative data were analyzed using narrative method and triangulation of findings from both sources was done at the interpretation phase. The results indicate that 70.5% of the respondents believe that public health & sociocultural effect evidently observed as a result of the dam construction activities. The findings also identified three major priority areas with top importance indexes. Accordingly, impact on human health is the first top priority with overall relative importance index (RII=0.70) including HIV/AIDS & STI (RII=0.876), drug addiction (RII=0.739) and bad smell with RII= 0.478 as specific item of human health factor. The second most important item is ecosystem effect with overall relative importance index (RII= 0.69) while deforestation with (RII= 0.898), soil erosion (RII=0.798), loss of wildlife (RII=0.676) & loss of biodiversity with (RII=0.555) are considered as specific items. The third most important item with overall relative importance index (RII=0.59) is natural resource impact comprising dangerous excavation (RII=0.796), loss of aesthetic value (RII=0.583), over extraction of materials (RII= 0.514) and change of landscape (RII=0.450) as sub category. Thus, this study suggests that the project needs to set integrated plan prior to implementation of the project.

Key words: Development, Post-Project, Environment, Effect, Electric Power, Corporation,

CHAPTER ONE

I. INTRODUCTION

1.1. Back ground of the study

The interrelationship between economic development, environmental management and human well-being is a complicated process and affects both the quality and sustainability of the society in which we live (Matheus and Goosen, 2005). According to Gutti *et al* (2012), exploitation of natural resources is an essential condition of human existence, throughout the history of mankind. Humans have manipulated the natural resources to produce the materials they needed to sustain the growing human populations. Uher and Lawson, (2012), over exploitation of natural resources are associated with human desire to improve well-being using advanced technologies.

Environmental issues are becoming a global agenda demanding integrative approach while planning and implementing development projects regardless of their type, size and scope in any country. While talking about the environment and development projects, various researches emphasized the nexus between project implementation and environment friendly approaches. Remarking to these ideas, World Bank (1997:pp5) emphasized the importance of integrative approaches; "the old notion of 'development versus environment' has given way to a new view in which better environmental stewardship is essential to sustain development".

As one of the development projects, construction is the major cause of environmental damage. In support of this, Rizqa and Abusharar, (2014), stated that the impacts on the environment caused by construction activities are serious and need to be controlled.

Similarly, Zhai et al., (2007), indicated that large-scale engineering construction has caused the enormous pressure to the regional ecological environment and changed the regional ecologic balance.

The authors added that ecological problems tend to increase with the expansion of construction industries as it depends largely on the environmental resources as its raw materials. Researches indicate that linkage between construction project activities and their impact on environment are overlooked. Stating the fact that development projects have to consider this linkage and be environment friendly and consider the importance of integrative approach to development, Kaur and Arora, (2012) stressed the need to have a development project plan to be planned in such a way to achieve a balance i.e., maximum positive development impact and at the same time minimum negative environmental impact.

Even though the environmental impact of construction activities is severe, researches indicate that these impacts can be restored if identified properly and strategies designed before commencement of construction activities. Supporting this, Gangolells et al, (2011) stated that identification of the environmental impacts of construction activities will help to enhance the effectiveness of environmental restoration and its management systems. Linnea, (2015) also underlined, if defined carefully, ecological restoration has the potential to restore damaged ecosystems

However, attention given to restoring damaged environment after completion of construction activities is minimal. In support of this, Azqueta, (2012), stated that in most cases, due attention is given for pre design and sometimes during construction phase of environmental impact. However, the issue of environmental impact of post construction phase and the necessary restoration activities are downgraded and over looked and therefore, left unattended. Also according to Mark (2010), various policies focus on pre-construction designs that mostly translate in to construction and post construction phase is ignored in land use planning and given only minimal attention by built environment practitioners.

In Ethiopian context, different development projects have been implemented and in this regard construction mega projects are the major ones that significantly damage environment as they uses huge human and natural resources. In support to this, Adugna, (2016) states that lack of well

prepared pre feasibility study for development projects remained a major problem of environmental damages.

GIBE III Hydro Electric Power (HEP) dam project is one of the mega projects completed four years ago. However, there is a lack of scientific study indicating its construction activities impact on the environment and portraying the picture of post-project restoration practice before moving to other project.

In this regard, the national report on assessment of the impact of construction projects on the environment and its restoration practices indicated that majority of the projects overlooked the rehabilitation of the disrupted environment due to their activities before leaving the site (EPA, 2006). Likewise the GIBE III HEP project somehow expected to be not exceptional to the national context. Therefore, due to lack of recent studies on the impact of the project on environment and its restoration practice necessitated a systematic study at GIBE III HEP project construction site in the border between Wolayta and Dawro Zones, SNNPR.

1.2. Statement of the problem

Environmental impact of construction activities has been gaining greater attention all over the world and its management also required by law in many countries (Teixeira, 2005; Tam et al., 2006; Cole, 2000; Ofori et al., 1999). Construction activities cause environmental damage and these include waste production, soil erosion and contamination, destruction of plants, loss of animal habitat and the like (Esin and Cosgun, 2007; Tamet al., 2006; Teixeira, 2005; Cole, 2000). However, if such impacts identified properly, the damaged environment can be restored. As to Ijiga et al., 2013, identification of possible impacts of construction projects on the environment is a task that needs to be accomplished for the realization of more effective environmental management.

Globally, various researches have been carried out in identification of the environmental effect of construction activities (Li. et al, 2010 and Zolfagarian et al., 2012,). The findings of these studies categorized the effects in to Ecosystem, natural resource and public health effects.

A study conducted by Gangolells et al, 2009; Teixeira, 2005; Blodgett, 2004; Blodgett, 2004; Cole, 2000; Choi, 1997 found out that excessive noise as a major problem caused by heavy machineries and construction equipment during construction. Also according to the finding of a study conducted by Teixeira, 2005; Blodgett, 2004; Choi, 1997 shows that dust generation due to excavation and demolition activities is the main environmental problem.

Similar study conducted by Ayarkwa, J., Acheampong, A., Hackman, J. K. and Agyekum, K. (2014) identified sleeplessness, stress, and respiratory infections as public health problems associated with construction activities.

The environmental impact due to construction activities is also observed on natural resource consumption. Some available statistics shows that construction activities accounts for 30-40% of energy consumption, 40% of virgin materials extracted, 25% of wood harvested and 12-16% of fresh water consumption.

The same studies have also been conducted in African context showing such environmental effects as dust, noise, water pollution, waste and ecosystem (Ebohon and Rwelamila, 2001). Studies conducted in Ethiopia, indicated that damages occurring on natural and social environments are attributable to construction activities (Solomon, 2009).

However, as can be seen these studies were conducted and identified environmental impacts during the construction phase. According to Hostetler; 2010 researches and policies were focused on the environmental effects and restoration practices occurred during the construction phases and not during post-project construction period. Moreover, the units of analysis in most of the researches indicated above were mainly construction practitioners and technical parts (Zolfagharian et al.,2012; Ayarkwa, J. et al 2014). Moreover studies specifically conducted on hydroelectric projects are limited.

Identifying the environmental impact is, therefore important for successful restoration and management effectiveness. In support of this, Gangolells et al. (2011), Zolfagharian et al. (2012)

stated that identification of the environmental impacts of construction activities will help to improve the effectiveness of environmental management systems. Also Gangolells et al. (2011) stated that determining major environmental impacts will assist to consider a range of on-site measures in order to mitigate those impacts.

Therefore, taking GIBE III HEP dam project as a case study, this research study sought to fill the aforementioned gaps focusing on identification of post-project environmental effects of construction activities, its restoration practices and the management effectiveness in GIBE III hydroelectric project site and tries to contribute as an input to policy development and further research. Moreover, it also attempted to fill the gap making communities its unit of analysis assessing their perception towards the environmental impact caused by the construction activities of the GIBE III dam and restoration activities implemented after the completion of the dam project.

1.3. Objective of the Study

1.3.1. General Objective of the study

The general objective of this study is to identify the post-project environmental effect of construction and restoration activities in GIBE III Hydroelectric dam project site

1.3.2. Specific Objectives of the study

- To identify the environmental impact of post-construction activities.
- To identify the post-project environmental restoration activities.
- To assess the effectiveness of environmental restoration management system of the project

1.4. Basic research Questions

- What are the post-project environmental effects of the construction activities in GIBE III HEP project site?
- What are the environmental restoration activities being implemented in the construction site?
- Is the environmental restoration management system of the project effective?

1.5. Significance of the Study

Beyond its importance as partial fulfillment for Masters of Arts in Environment and sustainable development, the study designed to fill the gaps in identifying environmental impacts due to the construction activities and implementation of mitigation measures so that the research finding and lesson help policy makers to formulate appropriate policy and strategic measures. The research also helps implementers and supervisors of hydroelectric dam project in performing effective restoration intervention. Moreover, the study is believed to serve as a secondary data source for further researches to be carried out in the future.

1.6. Scope of the Study

The study is delimited to GIBE III hydroelectric dam project done on Omo river that is located between part of Kindo Didaye woreda of Wolayta Zone and Loma Woreda of Dawro Zone. The study identified the environmental impact of construction activities and its restoration practices in GIBE III HEP dam project site.

1.7. Limitation of the Study

The major limitation of this study was that due to lack of time and resource, it was only focused on the general categories of environmental factors and did not focused on specific ones. More over analysis of specific environmental factors need multidisciplinary knowledge and skill.

CHAPTER TWO LITRATURE REVIEW

2.1. Theoretical Literature Review

2.2.1. Definition of Sustainable Development

The term sustainability reflects the need for careful balance between economic growth and environmental preservation. Although many definitions exist, Sustainability generally refers to "meeting the needs of the present generation without compromising the needs of future generations" (WCED, 1987). According to Michael and Stephen (2001; pp485), in a classical definition, a development path is sustainable "if and only if the stock of overall capital assets remains constant or rises over time."

Auliana, (2007) also defines sustainable development as by sustainable development we mean the use and exploitation of today's resources in such a manner that these resources will be available for use by future generations. In other words, consumption today is with tomorrow in mind. According to Duran et al. (2015), sustainable development is a development that protects environment, because a sustainable environment enables sustainable development.

As to Sterling (2010), sustainable development is a reconciliation of the economy and the economy and the environment on a new path of development that will enable the long- term sustainable development of humankind. According to Michael and Stephen (2001) complete sustainable development can be achieved through the balance between social sustainability, economic sustainability and environmental sustainability.

2.2.2. The concept of Sustainable Construction

The term "development" includes activities across different industry sectors. As the impact of construction industry on both physical and human environment rates as one of the highest among all the industries, a careful scrutiny of the construction industry is necessary to minimize its

impact on environment, results in the emergence of the term 'Sustainable Construction.' Uher and Lawsen, (2002).

Sustainable construction originally proposed to describe the responsibility of the construction industry in attaining sustainability (Spence and Mulligan: 1995 pp280), defined sustainable construction as the creation and responsible maintenance of healthy built environment based on resource efficient and ecological principles. What is inherent in all the above definitions of sustainable construction is the issue of proper functioning of the ecosystem to keep healthy environment is emphasized.

Sustainable construction is therefore any construction activity that consider identification of environmental damage occurred due to construction activities, the restoration of damaged environment in all phases of the construction i.e., initial, during and post construction through effective management is the operational definition used in this study.

2.2.3. Environmental Protection

Nowadays when development becomes an agenda, one of the issues never wanted to be forgotten is the issue of environmental protection. Particularly when sustainability of development rises, environmental protection is an inevitable topic to be discussed. Underlining this Ijigah et al., (2013) states that topic of environmental protection is hot in both developed and developing countries.

The impact of construction on environment is significant. As to Levin (1997), construction entails direct and indirect impact on physical and biological as well as social environment. Therefore, according to Ijiga et al (2013) to identify the possible environmental impact identification has to be the important task to be considered in order to achieve sustainability of environment.

Shen et al, (2005) and Li et al (2010) put the impact of construction on environment as of all industries that generate high level pollution and in general not environmental friendly sector.

According to Zolfagharian, 2012, the perception and knowledge of practitioners with regard to environmental protection issue in construction industry need to be enhanced

2.2.4. Environmental Impact of Construction

Environmental impact is defined as any impact caused by a proposed development activity on the environment including effects on human health and safety, fauna and flora, soil, air, water, climate, landscape and historical monuments, or other physical structure Donev et al. (2020)., Chen et al (2000), Cole (2000).

The impact of construction activities generated during the construction process relates to a number of aspects. According to Morledge and Jackson, (2001); Poon, (2001) summarized these aspects as resource consumption, dust and gas emission, disruption of people through noise and traffic diversion, consumption of renewable and nonrenewable resources, forest clearance, landscape change, loss of biodiversity, soil erosion and compaction.

Enhancing the identification of major environmental impacts of construction process will help to improve environmental management system (Environmental impact assessment on construction site, conference paper, May 2012). According to Cole 2000, Texeria 2005, and Levin 1997, the direct, indirect and cumulative impact of construction are land utilization and river and stream diversion as direct, land erosion, pollution and deforestation as indirect and change of wildlife habitat due to deforestation, increase in temperature due to forest and vegetation removal as well as landscape change as cumulative impact. Even though environmental impacts are various in nature and kind, general categorization has been made in literatures. Accordingly, Environmental impacts are generally categorized into three safeguard subjects: ecosystems impacts, natural resources impacts and public impacts (Li et al., 2010; Chang et al., 2011; Zolfagharian et al., 2012). This study used theses categorization for analysis having environmental factors under each category.

2.2.4.1 Ecosystem Impact

It **is** the effect left on organisms and their environment due to actions made by humans and natural occurrences (Glossary of Environment Statistics, 1997). Adverse environmental impacts include wastes, dust, land use, operation with vegetation, soil deterioration, bad smell, water and air pollution. (Zolfagharian et al., 2012). Even though ecosystem impacts are of various kinds, Wastes, soil erosion, deforestation, loss of wild life and biodiversity are impacts for analysis for the purpose of this research work. The reason to focus on these impacts is that some of the impacts like climate change are beyond the scope of this research and some impacts like dust and noise are impacts occur during construction period rather than post construction period.

2.2.4.2 Natural resource impact

Natural resource impact is the impact on natural resource like land, material and water (Shen et al., 2005:pp208). Construction industry contributes significantly to environmental abuse like raw material consumption and change in landform (Li et al., 2005). Natural resource impact in this research study includes overconsumption of raw material, dangerous excavation, change in landscape and loss of aesthetic value.

2.2.4.3 Public health Impact

Researches show that construction activities causes serious public health impact on the nearby communities (Li et al., 2005, Tam et al., 2004, Zolfagharian et al., 2012). A study conducted by Li et al.,2005 demonstrated that health damage caused by construction activities accounts for 27% of the total impact which is less than ecosystem impact (65%) but more than natural resource impact(8%). This implies that implementing health intervention after completion of construction activity is important. Such public health factors as HIV/AIDS, Bad smell and drug addiction are analyzed in this case study.

2.2.5. Environmental Restoration

The Society for Ecological Restoration defines environmental restoration as "the process of assisting the recovery of an ecosystem that has been degraded, damaged or destroyed (SER, 2004; pp2). Larry and Hayden, (2012) also defines restoration as returning of resources to a pre-development and pre-damaged condition. Looking at the definitions given have commonly underlined the need to bring damaged environment to its original state so that the proper functioning of ecosystem to be maintained.

Researches also indicate that the benefits of restoration are multidimensional. According to Aronson et al, (2007 pp209), restoration has such product benefit as promoting wildlife habitat, biodiversity and sustainable harvesting of "natural capital"

Linnea (2015) stressing this fact states that ecological restoration has the potential to re-build the relationship between nature and humans. If defined carefully, ecological restoration has the potential to restore damaged ecosystems.

2.2. Regulatory Frameworks

2.2.1. Environmental National Policies and Strategies

The constitution of the Federal Democratic Republic of Ethiopia (FDRE) dictates important provisions relevant to the country's environmental policy: Art. 44 of the constitution states that all persons have the right to live in a clean and healthy environment, and also Art. 92 obliges the government to make all efforts to provide every Ethiopian with clean and healthy environment (FDRE constitution, 1995)

An article 91 and 92 also states that the government and the people of Ethiopia are responsible for the protection of natural resources and maintenance of ecological balance.

2.2.2. Environmental Policy of Ethiopia (EPE)

The Environmental Policy of government of Ethiopia (EPE) was approved by the council of Ministers in April 1997. The policy has the objective of rectifying previous policy failures and deficiencies which in the past have led to serious environmental degradation. EPE is fully integrated and compatible with the main long terms economic development strategy of the country, known as Agricultural Development Led Industrialization (ADLI), and other key national policies like the national population policy.

The main goals of EPE can be summarized in terms of improvement of the health and quality of life of all Ethiopians and of promoting sustainable social and economic development through the adoption of sound environmental management principles. Specific objectives of the policy and key guiding principles are set out clearly in EPE, and expanded on various aspects of the main policy goal.

The policy further states that, environmental sustainability is recognized in the country's constitution and in the economic policy and strategy as a key prerequisite for lasting success.

The EPE encompasses sector and cross sector policies and also provisions for the appropriate implementation of the policy itself. Among the sector policies, Water resources policy and biodiversity policy can also be cited as the ones that already were implemented in the country. (Electro consult, 2004). The policies for forest, woodland and tree resources, Genetic species and ecosystem biodiversity, control of hazardous materials and pollution, human settlement and environmental health are most relevant ones for this study.

2.2.3 Environmental Impact Assessment (EIA)

As environmental protection organ, an environmental impact assessment (EIA) is the responsibility of both the Federal and regional environmental agencies, which are mandated by both EIA proclamation (Proc. no 299/2002) and the Environmental Protection Organs Establishment (EPOE) Act (Act no.295/2002).(Adugna, 2012).

The proclamation of EIA (Proc. No. 299/2002) has been put in place to oversee the implementation of EIA. The proclamation has made EIA to be mandatory requirement for development projects that potentially entail environmental damage. According to Adugna (2012) this proclamation is a proactive tool and a backbone to harmonizing and integrating environmental, economic, cultural, and social considerations into a decision making process in a manner that promotes sustainable development.

2.2.4. Conservation strategy of Ethiopia (CSE)

The Government of Ethiopia (GOE) has undertaken several initiatives since 1990s to develop National, Regional and Sector strategies for Environmental conservation. One of these initiatives was the CSE, approved by the council of ministers. CSE provided a strategic framework for integrating environmental planning into existing policies, programs and projects.

The CSE provides a comprehensive and rational approach to the management of environment in a more broad sense, covering National, Regional and Sector Strategies and cross sector strategy, action plan and programs. It has also established the basis for development of appropriate institutional and legal frameworks for implementation of the strategies (EPA, 1996).

2.3. Environmental Management Plan And Monitoring

2.3.1. Environmental Management plan

The environmental management plan contains every aspect of a project and should be prepared by the contractor before work commences on any construction project. Once the environmental site and risk assessments, and risk management steps have been completed, then implementation of risk management measures is achieved via the environmental management plan.

Concerning the management of environmental impact of the construction of GIBE III HEP project, the contract document signed between Ethiopian Electric Power Corporation (EEPCo) and Salini Impregilo S.p.a, the contractor should put in place Environmental management System (EEPCo, 2005). The Environment and Climate Change Commission (ECCC) is the

highest body to oversee the implementation. However, the periodic follow up and supervision is mandated to the Ministry of Water, Irrigation and Energy (MWIE).

According to the Environmental and Social Impact Assessment (ESIA) report (2007), the environmental management plan is comprised of a series of management plans. Each plan is under separate section by environmental components. Each management plan contains specific environmental mitigation and enhancement measures. The document states the project contractor is responsible for implementing the majority of the day-to-day, construction related environmental mitigation measures specified in this report and measures specified in the contract document (Project contract Agreement, 2005). However, EEPCO will be responsible for implementing environmental management measures associated with operation of the plant and the Gibe III reservoir. The effectiveness of implementation of such measures is to be assessed using the parameters developed for the purpose of this study. These parameters were developed based on the guidelines for environmental restoration project management developed by Society for ecological restoration (Andre C., et al 2005). These include environmental restoration goals and objectives, identified aspects of environment damaged, restoration activities plan, management structure responsible for restoration, monitoring and evaluation and reporting system.

2.3.2. Environmental Monitoring

Environmental monitoring program has been recommended and will be performed during all stages of the project (construction, commissioning and operation) to ensure that impacts are no greater than predicted, and to verify the predictions. For this project, it is recommended to carryout both compliance and effects monitoring. The monitoring has to indicate where changes to construction procedures or operations are required, in order to reduce impacts on the environment or local population. (EEPCo, 2007)

2.3.3. Empirical Review

Construction industry plays an essential role in the socioeconomic development and has a lot of significance to the achievement of national socioeconomic development goals of providing infrastructure, sanctuary and employment (Ofori, 2002).

Azqueta, (1992) states that even though, construction project development potentially contributes to the economic and social development, and enhancing both the standard of living and the quality of life, it is also associated with deterioration of the environment.

According to a study conducted by Zolfagharian et al, 2012, in consideration of the size of mega projects like hydro power, the ecosystem impact of construction activities has such adverse environmental impacts as solid wastes, soil erosion, and land use, operation with vegetation, water pollution, bad odor and climate change.

Similarly a study conducted by Zainora and Asmawi *(*2016), indicated that the activities of land clearing, excavation of site and its associated works will totally change or alter the environmental settings that lead to many environmental problems like land degradation, soil erosion, loss of biodiversity and so forth. A number of studies reported that construction industry is the major source of adverse consequences on the ecosystem, natural resources, and public health.

Construction activities, such as grading and filling, drastically reduce soil quality on construction sites left unprotected sites and it could be further degraded by erosion and adversely affect the surrounding environment. A study conducted by Cole, 2000 indicates that environmental impacts of the construction process cover resource use and waste generation, ecological loading and human health issues. Similarly, according to a study conducted by Teixeira, 2005; and Uher, 1999, show that construction activities may cause soil compaction, substantial increase in the soil level, opening of ditches and trenches, removal of the superficial soil layer, loss or damage to the roots, and damaging of the trunk and leaves.

Indicating the magnitude of impact of construction on specific environments, a study result conducted by Li et al. 2010 also found that construction activities results in ecosystem damage form 65% of the total impact and resource depletion form 8% of the total impact.

Andreas (2003) also indicated that the disturbance influence on surrounding wildlife, vegetation, hydrology, and landscape spreads much wider than the area that is physically occupied and contributes far more to the overall loss and degradation of habitat.

At the same time a study conducted by Lippiatt, 1999 states that it is expected that construction damages the fragile environment because of adverse impacts of construction, those impacts include resource depletion, biological diversity losses due to raw material extraction, land fill problems due to waste generation. Similarly a study by Dietz et al. (2001) showed that environmental impact of construction can be measured in the risk to human and ecological health as well as in the alteration of the course of nature.

As to the study conducted by Andreas (2001), construction activities results in, in most cases, imply a loss of wildlife habitat. The physical encroachment on the land causes disturbance and barrier effects that contribute to the overall habitat fragmentation due to construction activities. A clearly negative effect of the dam construction is the change in the landscape nature, surface depletion of the natural or semi natural landscape, including areas that are sensitive (wetlands, river valleys, and environmentally valuable (e.g. protected areas), in weakening the links between natural areas that forms a national or regional system of protected areas and, finally, a series of processes of the landscape transformations.

One of the adverse impacts of most construction activities is on natural resource endowment. This is in terms of the consumption of renewable and non-renewable resources. According to Shen et al., 2005, various natural resources are used during any typical construction process; these resources include energy, land, materials, and water.

According to Macozoma, (2012;pp278), Statistics indicate that construction and operation of the built environment accounts for nearly12-17% of fresh water consumption, 26% of wood harvested, 30-45% of energy consumption, 40% of virgin materials extracted, and 25-30% of greenhouse gas emissions.

According to Zolfagharian et.al, (2012; pp1750-1759) out of the many environmental impacts, ecosystem impact has the greatest impact with 67% of the overall impacts whereas natural resource impact accounts 21 % and public impact takes nearly 12% of the total impacts.

Also a study undertaken by Li et al, (2010, pp766-755) reveals that communities who live around construction sites are exposed to harmful health hazards due to wastes causing pollution from construction activities. The study finding of Tam et al, 2002 similarly indicate that during the construction phase of the project, dust and noise are regarded to be the two major factors affecting human health. Studies also indicate that prevalence of communicable diseases and social disruption are among the adverse impact of both construction and post-construction phase of projects.

According to Sabogal C. (2015), there is, therefore, an urgent need to accelerate the recovery of degraded ecosystems for the benefit of humans and nature. Consequently, research studies emphasize the need to identify environmental impact and the importance of restoration of degraded environment. Accordingly, a study conducted by Gangolells et al. (2011) stated that determination of major environmental impacts will assist to consider a range of on-site measures in order to mitigate those impacts.

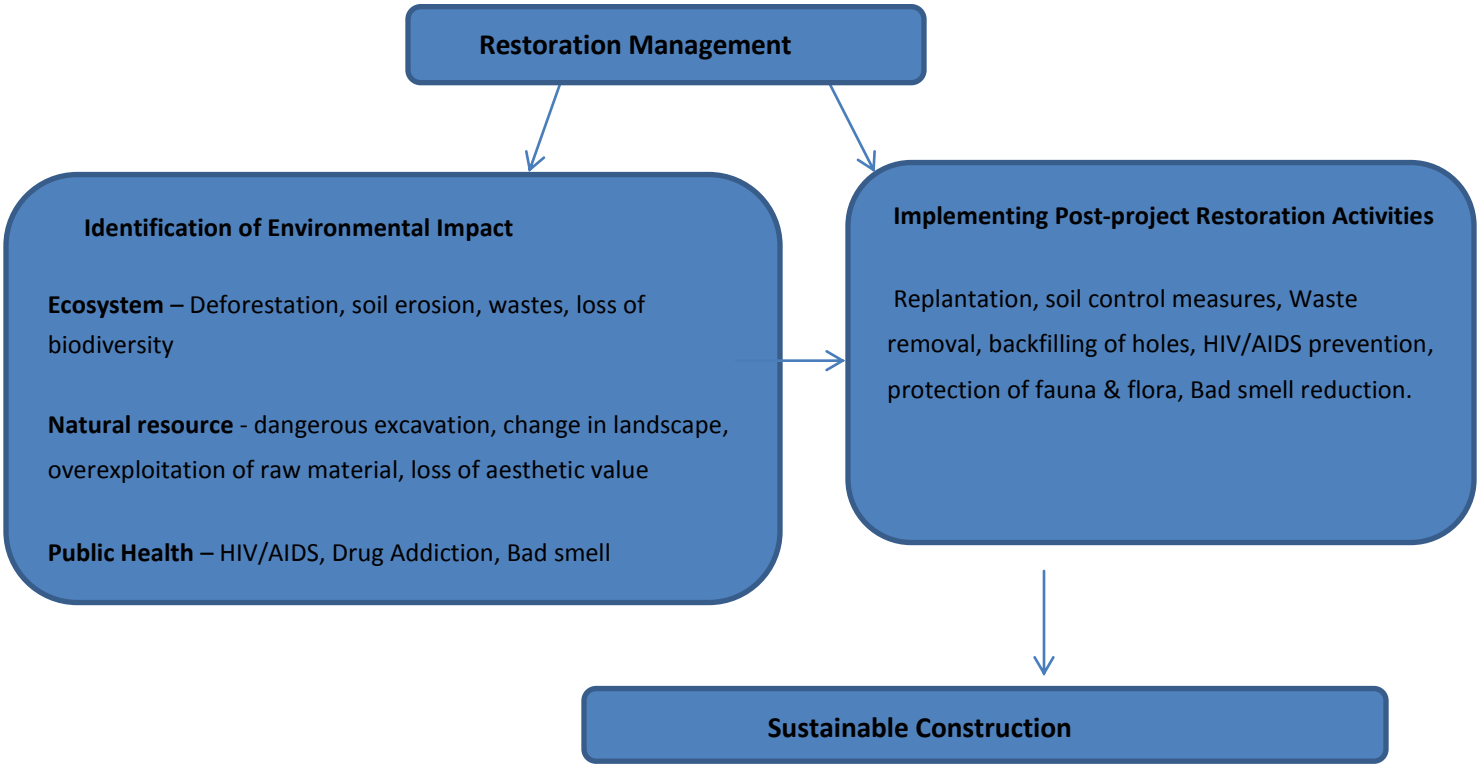
Researches conducted by Li et al (2010), Gangoles et al. (2011) show that creation of enabling environment for restoration practice is minimal. Indicating this a study conducted by Mark H., (2010) shows that particularly with regards to open space conservation and restoration of damaged environment, most of the policy effort is concentrated on the design phase with only token attention for the construction and post-construction phases. The problem is more common in developing countries like Ethiopia. Adding to this, Chrisna du Plessis (2002) observes that

construction projects in developing countries tend to focus on the relationship between construction and human development marginalizing the environment aspect. Also as to Lam 1997; Poon et al., 2001, it has been reported that very few contractors and private developers spend efforts in considering the environment because most of them rank completion time as their top priority and pay little attention to the environment.

Therefore, it can be concluded, from the conducted studies that environmental impacts of construction activities results in a serious issues but restoring such impacts are not sufficiently focused on. As a result, there need to develop a system that entails legal accountability to mitigate the construction impact on the environment to protect the ecosystem, natural resources and health of the community.

2.4. Conceptual Framework

Development projects need to be designed in such a way that the issue of environmental health is ensured for its success. Construction projects similarly need to be sustainable taking the issue of environment in to consideration in that environmental protection activities has to be carried out not only during construction phase but also in post-construction phase too. To achieve sustainable construction, therefore, identification of environmental impacts of construction needs to be carried out which helps implementation of post-project environmental successful if it is well managed.



Source: Own conceptualization: 2020

CHAPTER THREE RESEARCH DESIGN AND METHODOLOGY

3.1. Description of the Study Area

3.1.1. Location and Physical Environment

GIBE III Hydroelectric dam project is located in SNNPR and constructed on Omo River which dissects between the administrative structure of KindoDidayeWoreda of Wolayta Zone and Loma Woreda of Dawro Zone. The project site which is referred as catchment area is located in altitude above sea level of 700m.a.s.l. and 2280m.a.s.l. The topographic situation of the the site is sloppy, undulating topography, and mountainous, which is entirely found in the *Omo* river basin. (Salini Impregilo 2006)

3.1.2. Agro-ecology of the project site

The project area falls into the Kolla agro-ecological zone and has one annual growing period during the time of the summer monsoon (Keremt). The length of the growing period in the project area ranges between 46 and 90 days depending on elevation. (Loma Woreda: 2008).

3.1.3. Settlement and Socioeconomic environment

The settlement pattern of the population living within the catchment of the project site is sparsely populated while densely populated in the upper terrain and sparse as the altitude decreases towards the valley. Agriculture is the main economic activity among the population living around the project site. The type of farming is mixed farming. (EEPCo: 2009)

There is continuous land fragmentation due to increasing population pressures and transformation of steep slopes to the agricultural production. As a result majority of the

young married youths are landless and continuously migrate as livelihood strategy to casual labors in the different parts of the country. (Loma and Didaye Woreda: 2008)

As to the infrastructure of the area, there are three elementary schools, two health stations, one highway passing through from Wolayta Soddo to Jimma. According to Kindo Didaye and Gessa Woreda Administration offices, potable water coverage in the locality is around 37%. (Loma and Didaye Woreda, 2008).

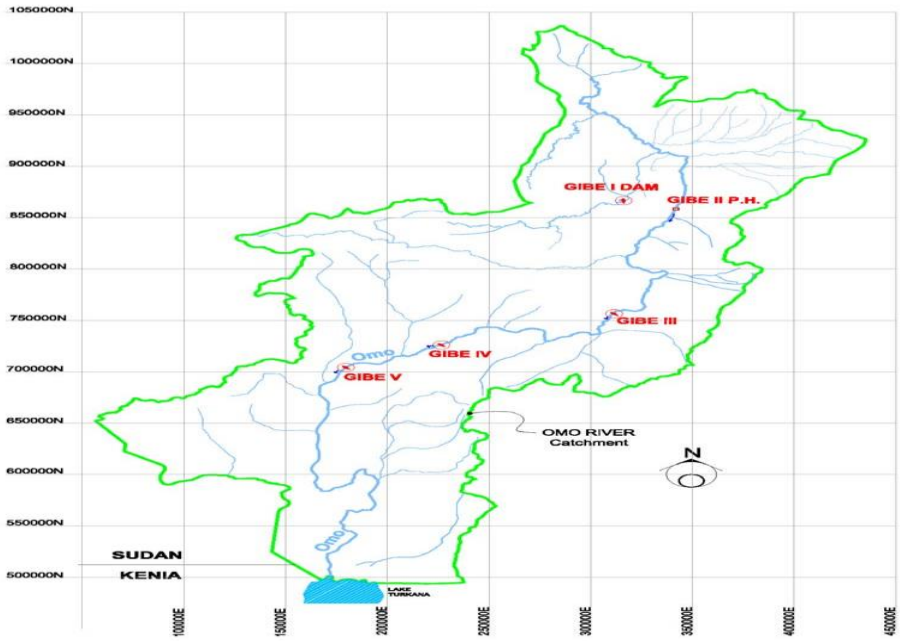


Image1. Location map GIBE III HEP project

Source: GIBE III project archive

Image2. Topographic view of the project site

Source: GIBE III website.

3.2. Research Methodology

3.2.1. Research Design

The research design for this study was exploratory method that involves generation of both quantitative and qualitative data. The descriptive (qualitative) part was to describe the current practice of restoration activities whereas the quantitative data providing the empirical evidences so as to assess the impact of the construction in Gibe III Hydro-Electric power dam project. This is useful in exploring how individuals perceive factors affecting their environment as result of the construction in the study areas. It is also considered as the efficient approach of collecting data regarding characteristic of sample of a population, current practices, conditions or needs. In addition, it describes what actually exists within a situation, such as current practices and situations of different aspects of the factors.

3.2.2. Research Approach

The researcher has assumed that mixed type of research as the most appropriate approach due to different reasons. The reason why mixed approach was preferred include:- to develop a more complete understanding of the phenomenon under study settings; to cross-validate or corroborate findings and to provide a well-validated and substantiated findings. Therefore,

both qualitative and quantitative data were generated through different approaches so as to respond the research questions. Mores (2003) indicated that in concurrent research the investigator gathers qualitative and quantitative data at the same time and analysis are conducted separately yet concurrent. Thus, the findings from both qualitative and quantitative data analysis were triangulated and the integration was done at the interpretation phase of the study.

3.2.3. Sampling Frame

Sampling frame is a list or set of directions for identifying all elements in a study population. It is a list of all those within a population who can be sampled and may include individuals, households or institutions (Kothari, 2004). Accordingly, two kebeles i.e., *Zaro* from Wolayta Zone and *Afuqi* from Dawuro Zone were selected purposively using stratified sampling. The reason to select these kebeles was that the project construction site is fully located within parts of these Kebeles. Therefore as shown in the table 3 the population for the study includes household living in these Kebeles.

. **Table 3 Target Population**

No	Households from each Kebele	Total population
1	Household from Zaro Kebele	178
2	Household from Afuqi Kebele	134
	Total	312

Source: Own, 2020

3.2.4. Sample Size determination

In conducting a research study, it is too costly to test everything or contact every person in the entire population. Therefore, a smaller hunk of a unit sample has been chosen to represent the relevant attributes of the whole of the units (Kothari, 2004). Therefore, the sample size for households was determined from the study population by Yamane (1967) as given hereunder.

$$n0 = \frac{N}{1 + N\ (e5)^2}$$

Where N is the total population,

n0= adjusted sample size

e =Sample error at (5%)

If the population is small then the sample size can be reduced slightly by the adjustment called the finite population correction which can be reduce the necessary sample size for small population (Israel, 2009) based on the above formula the researcher determined the sample size as follows:-.

The sample from the total household $n0 = \frac{312}{1+312\ (0.05)^2}$ = 175

Thus the total sample size in the study is 175.

Since the population is less than 10,000 the following corrections formula is used

n = 175/1+175/312

= 175/1+0.5608

= 175/1.5608 = 112

Sample size (n) = 112 households

Table 3.2 Target population and sample size determination

No	Kebele	Total population	Proportional sample	Sample size
1	Zaro	178	178/312*112	64
2	Afuqi	134	134/312*112	48
	Total	312		112

Source: Kebele Administration report, 2020 (Zaro and Afuqi)

3.2.5. Sampling technique

A sampling technique is a definite plan for obtaining a sample from a given population. In order to enhance generalization and validity of the study, taking adequate sample size and employing appropriate sampling technique given special care and emphasize, because, taking the whole population for study is not viable, costly and difficult. So, it needs to take small size out of the whole population of the study area (Kothari, 2004). After determining the sample size, the researcher used simple random sampling method to get the appropriate respondents for the purpose of distributing questionnaires.

3.2.6. Types, sources of data and data collection methods

Both qualitative and quantitative data were collected from primary sources. The primary quantitative data sources of this study were households living around the project site and also project management staff of Ethiopian Electric Power Corporation and the project contractor office. The primary data were collected using various tools such as questionnaire, interview, observation, and document review. The questionnaires embrace both closed and open-ended questions which allows for the collection of large amount of data from selected samples. Interview (KII) for two groups was also conducted to generate qualitative data. The first group is comprised of 6 (Six) elders and prominent community members about environmental damage and its restoration activities and the second group was comprises of 8

(Eight) senior management staffs from the Ethiopian Electric Power Corporation Project Office and the contractor to generate data about management effectiveness.

In addition to assess the impact and restoration practice self-developed questionnaire was used. It includes five items designed to assess the perception of the community members on ecosystem, natural resource and public health impact in the study area. Each item is rated using five-point Likert scale ranging from 1 (highly sever) to 5 (low impact). In the case of measuring the effectiveness of the restoration practice is ranging from 1 (poorly restored) to 5 (well restored).

3.2.7. Data Analysis and presentation

The data were presented by frequency table and charts; and were analyzed using SPSS 21-version and Excel 2007 program. The researcher employed both descriptive and inferential statistic methods to analyze the data collected from survey and narrative method for interview results. The descriptive statistics was applied by using frequencies and percentage to describe the nature of the data collected and summarized in tabular form. Regarding the inferential statistics, index matrix was employed to identify the strength, and relative importance of the factor. Then, the findings from both quantitative and qualitative data analysis were triangulated and the integration was done at the interpretation phase of the study.

Concerning the inferential statistics to calculate the relative importance Index, the following formula was applied as suggested by Tam et al (2000).

$$RII = \frac{\sum W}{A * N}$$

where w is the weighting given to each factor by the respondent, ranging from 1 to 5; ‘1’ is the least strong impact and ‘5’’ is the extremely strong impact for environmental impact and ‘1’ is poorly restored and ‘5’ is well restored for restoration practice; “A” is the highest weight; in this study it is 5; and N is the total number of samples. The RII shall be a variable ranging from 0 to 1.

3.2.8. Ethical Considerations

In the process of conducting this research, care was taken so as to make the research ethically sound. Thus, in the process of data collection, first, the consent of respondents were asked and approved and then they were informed the purposes of the research and the anonymity and confidentiality of their information as well as their privacy to be secured. Besides, proper data gathering procedures were followed to avoid faulty data gathering procedures. The works of other researchers were given great value so that they were acknowledged (cited) properly. All individuals and groups or organizations that play significant roles for the success of the study were also acknowledged.

CHAPTER FOUR RESULTS AND DISCUSSIONS

4.1. Demographic Characteristics of respondents

4.1.1. Sex of the respondents

As can be seen from the pie chart in figure 4.1 of the total 94.6% of the respondents are male while the rest are female. This indicates that the study addressed majority of male household heads even though the sampling method was non-probability sampling particularly availability sampling method. This is due to the characteristics of rural households which are dominated by male headed households. In most rural areas, households don't stay longer being single, widow or separated as the life style force them to be couple to help each other house management and farming (Howard and Smith, 2006), Therefore, proportion of female headed households in rural Ethiopia is mostly small.

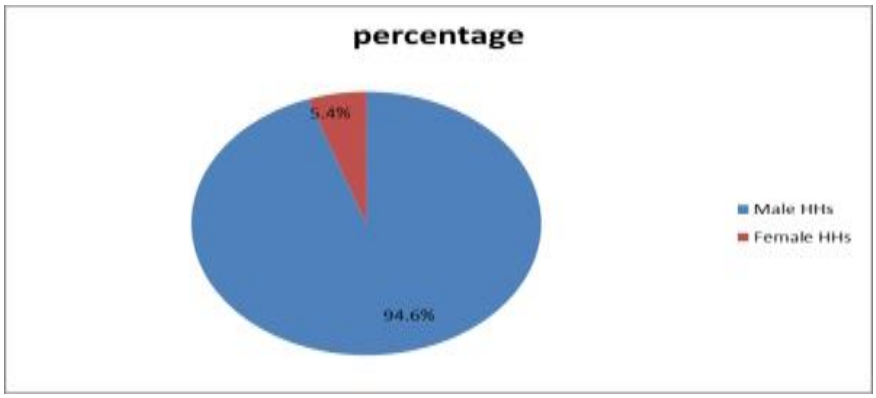
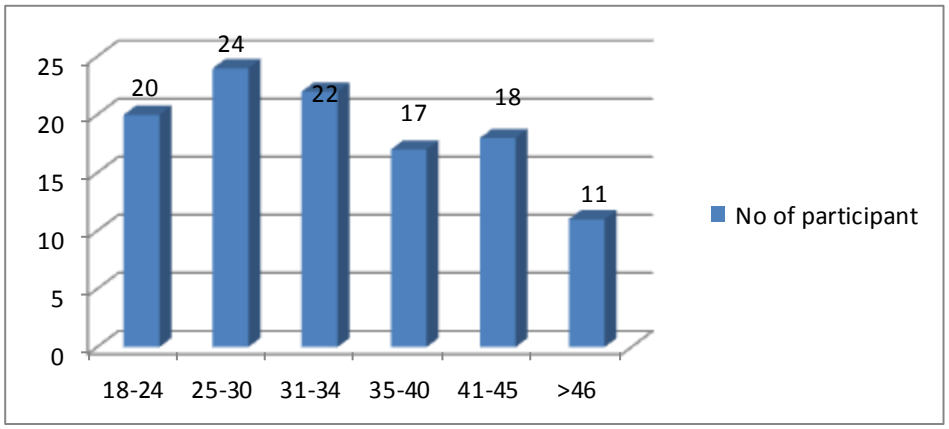


Figure 4.1 Sex of the respondents

Source: own survey, 2020

4.1.2. Age of the respondents

While discussing about the age of the respondents, as indicated in the bar graph (Fig.4.2) below more than half of them (66) are between 18-34 years of age, few of them (29) are above 41 years of age. As the age structure of population in most developing countries shows high number of young population, the pyramid is broader at the base (UN, 2017). Similarly in this study 90% (101) of the respondents are at the productive and reproductive ages implying that the project has an opportunity in using the young population to actively engaging in restoration activities. In addition, it has implication for the project to focus on reproductive health interventions to implement among the study community.



Source: Survey result, August 2020

Figure 4.2 Age of the respondents

4.1.3. Educational Status of Respondents

As indicated in table 4.1. below, concerning the educational status of the respondents, while only 19 % were illiterate, majority of them that is 76% have primary and junior secondary education level and the remaining 5% of them achieved higher education and above. This shows that a great majority of respondents in the study area can easily get written information about environment and understand basic concepts regarding environmental damage and restoration benefit.

Table 4.1 Educational status of respondents

Educational Status	Frequency	Percentage
Illiterate	21	19
Primary	58	52
Secondary	27	24
Higher Education	6	05
Total	112	100

Source: Survey result, August 2020

4.1.4. Family Size of respondents

Regarding the family size of respondents in table 4.2 below, while about 70% of the households have family size ranging from 1-6 members, the remaining nearly 30% have more than 7 family members. This is also similar with CSA (2007) data which shows the average family size in the study area is 5.7.

Table 4.2 Family size of respondents

Family size	Frequency	Percentage
1-3	14	12.5
4-6	65	58.0
7-10	21	18.8
Above 10	12	10.7
Total	112	100

Survey result, August 2020

4.1.5. Marital status of respondents

According to table 4.3 below, of the respondents' majority of the household heads that is 82.2% are married, 5.3% are single, 1.8% is separated and some 10.7% are widow. This implies that most household heads are leading stable family and the study area is not socially disrupted.

Table 4.3 Marital status of respondents

Marital status	Frequency	Percentage
Married	92	82.2
Single	6	5.3
Separated	2	1.8
Widow	12	10.7
Total	112	100

Survey result, August 2020

4.1.6. Economic Activities of the respondents

The other socioeconomic information of the respondents collected in the survey questionnaire is major means of livelihood. As indicated in table 4.4 below, majority of them i.e., 97 or 86.6% relied on agriculture, 6 of them or 5.4% depends on petty trading and the remaining 9 or 8% lives on casual work. This information shows that the population in the study area is highly dependent on the natural environment and has implication that environmental degradation of any kind severely affects their livelihood.

Table 4.4 Major means of livelihood of respondents

Means of livelihood	**Frequency**	**Percentage**
Agriculture	97	86.6%
Petty trade	6	5.4
Casual work	9	8.0
Total	112	100

Survey result, August 2020

4.2. Environment Effect of GIBE III HEP dam construction activities

Identifying the types of environmental effects due to the construction of GIBEIII HEP dam project is analyzed and shows the following findings based on the questionnaire distributed to the sampled number of community members.

4.2.1. Knowledge of participants about environmental degradation

As to the extent of their knowledge about environmental degradation, in Table 4.5 below, the response of respondents indicate that 41(37%) of them have very good knowledge, 61 (54%) of them have some knowledge and 10 (9%) have little knowledge about environmental degradation. In this regard it can be said generally, that respondents have knowledge about damages up on natural resources or environmental degradation and also implies that the community around the project site in one way or another experienced or faced some kind of environmental degradation. As the topography of the project site is mountainous and ragged terrain, this is a common scenario in most part of the country.

Table 4.5 Awareness level of community about environmental degradation

Environmental degradation knowledge level	Frequency	Percentage
Very good	41	37
Good	61	54
A little bit	10	9
Total	112	100

Survey result, August 2020

4.2.2. Environmental degradation caused by GIBE III HEP dam construction

In terms of the environmental degradation caused by the construction activities of GIBE III dam project in their locality, under ecosystem effect, as shown in table 4.6. below while 62 of them or 55%, responded that deforestation is the major damage caused by the dam construction activities, some 38 respondents or 34% responded that it was soil erosion, 9 (8.0%) choose loss of biodiversity and 3 (2.7%) responded waste as the major effect occurred in their locality. This indicates that how the construction activities of the dam significantly affected the forest resources in the project site. As literature show this is mainly due to site clearance for various purposes like construction of residential camp, garages, and parking areas. In addition, of the natural resource category, 86 persons or nearly 76.8% of the respondents consider dangerous excavation as the major damage occurred due to the project construction activities, 15 of them or 13.4% believe it was raw material depletion, 6 (5.3%) responded landscape change and the remaining 5(4.5%) placed loss of aesthetic value as the damage on the natural resource in their surroundings.

As to which public health effect mainly resulted as a result of the dam construction activities, 79(70.5%) of the respondents responded that it was HIV/AIDS and STI, 29 (25.9%) responded drug addiction and 4 respondents or 3.6% considered Bad smell that were seen as a public health problem in association with the construction of GIBE III dam project. Public health impact in this regard is mainly associated with the coming of large number of workers

from various parts of the country. According to the annual report of the health stations in both Zaro and Afuqi kebeles HIV/AIDS and STI among communities increased significantly after the commencement of the dam construction in 1996.

Table 4.6 Environmental Impact of construction

Environmental Impact	**Freq**	**%**	**Environmental Impact**	**Freq**	**%**	**Environmental Impact**	**Freq.**	**%**
Ecosystem			**Natural resource**			**Public health**		
Deforestation	62	55.3	Raw material depletion	15	13.4	HIV/AIDS &STI	79	70.5
Soil erosion	38	34	Landscape change	6	5.3	Drug Addiction	29	25.9
Loss of biodiversity	9	8	Dangerous excavation	86	76.8	Bad smell	4	3.6
waste	3	2.7	Loss of aesthetic value	5	4.5			
	112	100		112	100		112	100

Survey result, August 2020

The picture below depicts that the previous healthy ecosystem within the project construction site was highly disrupted. The area was deforested, barren and difficult for the possibilities of growing plants as chemicals dumped there and because of severe soil compaction that limit a regeneration potential of the land.

Image 3, some parts of the environment damaged by the construction activities

4.2.3. Severity of environmental damage of GIBE III dam construction

Regarding the severity of the environmental damage occurred due to the construction activities of the dam project, as indicated in table 4.7 below, 24 (21.4%) of the total respondents responded that it was highly severe, 74 (66%) perceived severe, 11 respondents (9.8%) responded that it was medium and the remaining 9 of them or 8% perceived the damage was low. The variation among the participants is associated with the settlement duration of the respondents. According to Zaro kebele administration, some of the community members are new settlers and might not have experienced environmental degradation for long time.

Table 4.7, Severity of environmental damage

Severity of environmental damage	Frequency	Percentage
Highly severe	24	21.4
Severe	74	66
Medium	11	9.8
Low	3	2.6
Total	112	100

Source: Survey result, 2020

4.2.4. Community Perception on environmental Impact of GIBE III dam construction activities

As shown in the table below, in the ecosystem impact category, the respondents ranked "deforestation" in the first position (RII=0.898) as the most important ecosystem impact due to the construction activities of the construction of GIBE III HEP dam project. Next to deforestation, soil erosion and loss of wildlife with index value of RII= 0.798 and 0.676 respectively are the most important environmental impacts. When talking about the natural resource impact category, "dangerous excavation" is the most important impact caused due to the construction activities of the dam as ranked above (0.796). Among public health impacts, "HIV/AIDS & Sexually transmitted Infections (STI)" take the first position with (RII=0.876)

and are considered as the most important public health related impact caused associated with the construction of the project under study settings. This indicates that either due to poor management of the project or due to lack of the interest to post-construction interventions in the area has posed adverse environmental impacts on ecosystem, natural resources and public health issues.

Table 4.7. Community's perception of environmental impact of GIBE III dam project

No	***Environmental Impact***	***Level of impact perceived by participants***										
		Likert scale						***Weight***	***RII***	***Rank***	***Overall rank***	***Average RII***
		5	***4***	***3***	***2***	***1***	***Total respo.***					
I	***Ecosystems Impact***											*0.69*
1.	*Deforestation*	*68*	*34*	*7*	*3*	*0*	*112*	*503*	*0.898*	*1*	*1*	
2.	*Wastes*	*11*	*6*	*56*	*12*	*27*	*112*	*298*	*0.532*	*5*	*9*	
3.	*Soil erosion*	*53*	*24*	*18*	*16*	*0*	*112*	*447*	*0.798*	*2*	*3*	
4.	*Loss of wildlife*	*15*	*42*	*26*	*29*	*0*	*112*	*379*	*0.676*	*3*	*6*	
5.	*Loss of biodiversity*	*13*	*7*	*44*	*38*	*10*	*112*	*311*	*0.555*	*4*	*8*	
II	***Natural Resource Impact***											*0.59*
6.	*Over extraction of raw materials*	*1*	*4*	*65*	*30*	*12*	*112*	*288*	*0.514*	*3*	*10*	
7.	*Change in Landscape*	*0*	*2*	*43*	*48*	*19*	*112*	*252*	*0.45*	*4*	*12*	
8.	*Dangerous excavation*	*33*	*55*	*14*	*9*	*1*	*112*	*446*	*0.796*	*1*	*4*	
9.	*Loss of aesthetic value*	*5*	*22*	*39*	*41*	*15*	*112*	*327*	*0.583*	*2*	*7*	
III	***Impact on Human Health***											*0.70*
10	*HIV/AIDS &STI*	*67*	*32*	*2*	*11*	*0*	*112*	*491*	*0.876*	*1*	*2*	
11	*Drug Addiction*	*21*	*58*	*14*	*16*	*3*	*112*	*414*	*0.739*	*2*	*5*	
12	*Bad smell*	*0*	*5*	*41*	*59*	*7*	*112*	*268*	*0.478*	*3*	*11*	

Source: Survey result, 2020

4.3. Identification of Environmental Restoration Activities

As one of the specific objectives of this study, identifying the type and level of the restoration activities the project have been carried out in the project site were analyzed based on the respondents' response from survey questionnaire and their perceptions that were rated using the Likert scale. To the scope of this research study, activities that were targeted to restore the environment where while afforestation/replanting of trees, soil erosion control measures, protection of fauna & flora and wastes or hazardous materials removal under ecosystem, back filling of dangerous excavations, soil tilling & scarifying and reshaping of damaged land under natural resource and HIV/AIDS &STI prevention, psycho-social support, bad smell reduction and legal support under public health interventions.

4.3.1. Benefit of restoration perceived by the respondents

Regarding the benefit of environmental restoration, as shown in table 4.9 below, 39 of the respondents responded that forest resource increases, 28 of them responded flood decreases, 26 respondents replied wildlife rehabilitates and the remaining 19 of them choose increases soil fertility. The result, as can be seen indicates that communities in the study area are well aware of the environmental benefit of restoration and this could be taken as enabling factor for effective implementation of restoration activities.

Table 4.9 Environmental benefit of restoration

Restoration benefit	Frequency	Percentage
Rehabilitates wildlife	26	23.3
Increases forest resources	39	34.8
Increases soil fertility	19	16.9
Decreases flooding	28	25
Total	112	100

Source: Survey result 2020

4.3.2 Intervention after Completion of the Dam Construction

As indicated in the table below, based on survey result, regarding the restoration activities implemented under ecosystem category, 77 respondents or 68.8% responded waste removal, 16 (14.3%) responded re plantation, 12 (10.7%) choose protection of fauna & flora and the remaining 7 (6.2%) responded soil erosion control measures. This indicated that the project has been effective in waste removal than other measures regarding ecosystem.

When looking at restoring natural resource, of the respondents 68 of them or 60.7% responded reshaping of damaged land, 32 (28.6%) responded soil tilling & scarifying and 12 (10.7%) responded back filling of dangerous excavation as restoration activities after the completion of the construction activities.

As to the public health intervention, majority of the respondents i.e., 72 (64.3%) responded HIV/AIDS &STI intervention, 34 (30.4%) responded bad smell reduction and 6 (5.3%) responded psycho social support.

One of the areas that the project is expected to carry out after completion of the dam construction process is health intervention. Accordingly, when surveyed, while 96 (86%) respondents believed that the project has carried out health related program, few of them, i.e. 16 (14%) responded that the project did not carry out any health targeted interventions. Regarding the type of health intervention that the project has been carrying out in their locality, 77 (68.7%) of the respondents responded that it was HIV/AIDS&STI focused interventions that the project have been implementing, while some 5 (4.5%) noted that it was Psycho-social support related interventions, 11(9.8%) respondents responded bad smell reduction and the remaining 19 (17%) responded legal support provision to victims of rape. What can be concluded from the above information is that the project target to focus mainly on HIV/AIDS & other STI diseases is based on real health problem and the intervention is realistic.

Table 4.10 Post-project restoration Activities

Restoration activities	**Freq**	**%**	**Restoration activities**	**Freq**	**%**	**Restoration activities**	**Freq.**	**%**
Ecosystem			**Natural resource**			**Public health**		
Waste removal	77	68.9	Reshaping of damaged land	68	60.7	HIV/AIDS &STI prevention	72	64.3
replantation	16	14.3	Soil tilling & scarifying	32	28.6	Bad smell reduction	34	30.4
Protection of fauna & flora	12	10.7	Back filling of dangerous excavations	12	10.7	Psycho social support	6	5.3
Soil erosion control measure	7	6.2						
	112	100		112	100		112	100

Survey result, August 2020

4.3.3 Community's perception of environmental restoration after completion of the dam construction

Based on the community's perception as to the type and level of the restoration activities implemented during post-project period were analyzed using the respondents' rating of factors from the Likert scale in table 4.11 below. When looking at each category, from most implemented ecosystem focused restoration activities "waste removal" is ranked first which has a value of RII=0.789, from natural resource focused restoration activities "reshaping of damaged land" with a value of RII= 0.487 and "HIV/AIDS &STI prevention" having RII=0.910 from public health focused interventions took the first from their categories.

However, taking all factors of implemented environmental restoration activities in the project site and the surroundings, as indicated in the table (Rank in total column), "HIV/AIDS & STI intervention" is ranked first among activities most implemented during post-project construction period with highest value of (RII=0.910). Followed by "waste removal" and "bad smell reduction" with RII=0.789 and RII=0.658 respectively. Whereas "back filling of

dangerous excavations" is the most little implemented restoration activities having the value of RII=0.030. Also activities like "soil erosion control measures" (R=401) and "legal support provided" (RII=0.421) take the second and the third among the least implemented activities. This implies that the project did not implemented restoration activities on the most severe environmental impacts caused by the construction activities of GIBE III HEP dam project except HIV/AIDS & STI prevention. This means, in other words, such environmental impacts as deforestation, soil erosion and dangerous excavations were not given due attention to the level these impacts deserve.

Table 4.11 Post-project restoration activities perceived by respondents

No.	**Environmental restoration activities**	**Degree of Effectiveness Ecosystems Restoration**					**Total resp.**	**Weight**	**Index**	**Rank**	**Rank in Total**
		5	**4**	**3**	**2**	**1**					
1.	Plantation	9	14	39	29	21	112	297	0.530	3	3
2.	Wastes removal	33	61	11	5	0	112	442	0.789	1	2
3.	Soil erosion control measures	4	4	19	47	38	112	225	0.401	4	10
4.	Protection of fauna &flora	12	35	46	17	2	112	374	0.667	2	
Natural Resource Restoration											
5.	Dangerous excavations back filled	0	1	24	44	33	112	167	0.030	3	11
6.	Soil tilling and scarifying	2	11	37	40	22	112	267	0.476	2	7
7.	Reshaping of damaged land	7	15	27	34	29	112	273	0.487	1	6
Public health &psycho-social Interventions											
8.	HIV/AIDS &STI interventions	66	42	4	0	0	112	510	0.910	1	1
9.	Psycho-social support	3	18	42	20	17		253	0.451	3	8
10.	Bad smell reduction	25	51	22	8	6		369	0.658	2	4
11.	Legal Support	0	0	48	28	36		236	0.421	4	9

Survey result, August 2020

The image below is the area which was previously damaged by the construction activities and later replanted by the project contractor after the completion of the dam. This shows that there were some efforts to rehabilitate the area implementing plantation activities.

Image 3 Part of replanted area

Source: Image taken by the researcher, August 2020

4.3.2. Respondent's evaluation of restoration activities

As to how community's evaluation of post-project environmental restoration practice of GIBE III dam project, the survey result indicated that few of the respondents i.e 6 (5.3%) respondents rated very good, some 11 (9.8%) respondents perceived it was promising, also respondents who perceived it was below expectation counts about 56 respondents (50%) and 39 (34.9%) respondents perceived as poor. This means that the restoration practice the project has been carried out did not meet community's expectation and failed to meet its obligation. Moreover it implies that the project environmental restoration lacks essential project management elements like community participation.

Table 4.12 Evaluation of Post-project restoration practice

Evaluation of Post-project restoration practice	Frequency	Percentage
Very good	6	5.3
Promising	11	9.8
Below expectation	56	50
poor	39	34.9
Total	112	100

Survey result, 2020

4.3.3. Community participation in restoration activities

In terms of the status of community's participation, respondents were also made to respond in survey questionnaire. As indicated in the table below, regarding whether they have ever participated in restoration activities, 31 of them or (27.7%) responded that they have participated and 81 (72.3%) responded that they have not participated. This means that the project performance in ensuring stakeholder participation, particularly of the affected community in restoration activities was low.

Table 4.13 Community participation response

Response	**Frequency**	**Percentage**
Yes	31	27.7
No	81	72.3
Total	112	100

Survey result, August 2020

Regarding the frequency they have participated, 28 of them responded sometimes, 3 respondents responded rarely and the remaining 81 responded not at all.

In requesting whether they believe that their participation in restoration activities was important, all of the respondents or 100% responded that they believe it was important.

4.14 Community response on importance of participation

Response	**Frequency**	**Percentage**
Yes	112	100
No	0	-
Total	112	100

Survey result, August 2020

4.4. Effectiveness of the restoration management system

4.4.1. Document review and Survey Result

During data collection the researcher has attempted to make critical review of the project document using checklist which was developed based on such parameters as whether the project document contains articles enforcing the project contractor to take care of environmental issues in general and restoration of the disrupted environment in particular after the completion of the construction activities or not. Specifically, such management elements as restoration goal and objective identified environmental damages, restoration plan, management structure responsible for restoration, monitoring, evaluation and reporting system in the project employer and contractor management system. In doing so, the researcher has come out with the following results. These are: The document contains plan of interventions during construction, activity implementation, and monitoring & evaluation procedures and phases, reporting system and communication channels with the employer and funding agencies and community participation interventions. However, the researcher confirmed that the project contractual agreement document does not incorporate either the articles stating about restoration activities or any interventions both in the protection of the environment or employer's take over section which bind the implementer or contractor to do so. Even though the document in Article 4, sub article 18 states "the contractor shall take all reasonable steps to protect the environment to limit damage resulting from pollution noise and other results of its operation", it clearly shows that the causes mentioned are effects during the construction period and not in post-construction period of the project. In addition, the researcher got no statement relating to environmental issues in Article 10 of the document which is about employer's takeover of the project.

Regarding whether there exist restoration goal and objectives, it was found that no clearly stated restoration goal and objectives both in project employer and contractor offices. However, there was a restoration activities plan to be carried after the completion of the

project. As the survey result shows that the RII(0.530) under ecosystem restoration category indicates that some plantation carried out in the project site which is the result of project effort of establishing nursery site and resulting plantation on some damaged part of the land. The researcher took the image of some areas plantation carried out (image 3).

According to the project annual report of 2014, of the planned 4,200 community members to reach in awareness training on HIV/AIDS prevention and carry out voluntary counseling and testing, a success of 92% achieved. This shows that the project effort in the area of HIV/AIDS prevention done well which is in line with the RII(0.910) of the survey result.

Similarly from the document review, it was observed that the project has specific environmental protection plans. One of them was a plan to remove wastes from the project site safely. Accordingly, it was observed, too, that wastes of various kinds like plastic wastes and metal scrapes removed from the specific place they were accumulated. The finding from survey result also confirms this with RII value of nearly (0.8) which means that it was well restored. The reason from the interview conducted with management staffs indicate that most of the wastes were of plastic and metal scrapes and both employees and surrounding community members collect and sell it out since it was marketable in local market.

Regarding other ecosystem and natural resource restoration, even though there were no specific plans developed to restore such effects, there were regular reports showing the implementation of some restoration activities like back filling of dangerous excavations. However, the survey result shows that these were not satisfactorily restored with RII value of less than (0.5).

Regarding identification of damaged environment factors in need of restoration, there was no detailed list of previously identified environmental impacts by the employer and contractor as

well. This shows that the EIA conducted prior to project commencement was not referred and followed by the project management.

As to the structure of the project organogram, it was observed that there was environment section responsible to manage environment issues deploying experts.

The other management element the researcher tried to look at was monitoring and evaluation of the project periodic status assessment. Monitoring of the environmental issues carried out jointly with the employer. (Salini Impregilo, 2006). The finding from the check list as to the involvement of other stakeholders, however, shows that it was not clearly mentioned as to how and when stakeholders participate in restoration activities implementation. The finding from the check list provided to management staff of the project and the employer shows that the monitoring session has no regular time interval as planned. This shows that absence of local government and other organizations working in the areas of environment as well as lack of regularity makes monitoring and evaluation of restoration activities less effective.

4.4.2 Interview Result

Interview conducted to generate data regarding the effectiveness of restoration management. Participants were senior management staffs and experts from the project employer (EEPCo) and the contractor (Salini Impregilo S.p.a) and got the following result.

Asking if the project management set out clearly stated restoration goals and objectives, except knowing that the project contractor will carry out some activities all of the 8(eight) participants replied that they do not exactly knew there was a measurable and clearly stated restoration goals and objectives.

Regarding the quest whether the possible environmental aspects identified that need restoration after completion of the project, all of the participants except one (87.5%) from the project employer responded that they know which restoration activities to be implemented at the end of the construction of the dam. This implies that communication between the project employer and the contractor was clear and help them for coordinated action thereafter.

As to the activities action plan for implementation of environmental restoration, while 4 (four) of them or 50% of the participants replied that they know what activities to be implemented with its time frame and duration, the remaining 4 (four) or 50% replied that they only know the activities but not detailed implementation plan. The later four being staffs from the employer indicates that there was communication gap between the project contractor and employer.

In a quest if they believe the monitoring, evaluation and reporting system is effective, all of the interviewee (100%) replied that they don't believe implying that the restoration project execution was not well coordinated and created room for lack of quality and accountability.

For a quest if the project employer and contractor have a management structure responsible for environmental issues with technical capacity like having qualified experts, 6 of them (75%) responded that there is a structure with technical capacity and the remaining 2 (25%) replied not. This implies that both the employer and the contractor are in a capacity to implement restoration activities.

Generally, it can be said that the responsible bodies at project level i.e., the employer and the contractor have a potential but lack communication problem to effectively manage the restoration activities.

4.5. Summary of Findings

As indicated by Brewer and Hunter (2006), the researcher would develop confidence in the appropriateness of the scale, when parallel and comparable outcomes are obtained with two methods, i.e., using a questionnaire (survey research) and interview (qualitative research). Based on the concept of triangulation the finding from both sources are as follow:

- Regarding the knowledge about environmental degradation, 91% of survey respondents and all of the interviewed respondents replied that they have knowledge about environmental degradation.
- As to which ecosystem impact occurred due to the construction activities of the dam project some of the interviewed respondents and 55% of the survey respondents replied that deforestation or clearance of trees is the severe impact of the construction activities in and around the site.
- Regarding the factor of natural resource impact, nearly 77% of survey respondents and majority of the respondents of interview responded that dangerous excavation is the most highly impacted natural resource factor.
- Of the public health impact, while 70.5 respondents in survey questionnaire, majority of the interviewed informants replied that it was HIV/AIDS prevalence highly observed around the project communities.
- Regarding the environmental restoration activities, nearly 69% of survey respondents and some of the interview respondents responded that waste removal as implemented restoration activities among other activities.
- Of natural resource restoration activities, 60.7% of survey respondents and about half of the interview respondents replied that reshaping of damaged lands as restoration activities of the natural resource focused activities.

- As to the public health initiatives done by the project after completion of the project, 64% of survey respondents and majority of the interview respondents replied that HIV/AIDS prevention activities were public health focused initiative carried out by the project in the community.
- Regarding the overall evaluation of the restoration activities, great majority of the interview result and 84% of survey result show that the performance of the project in restoring the damaged environment was below expectation.
- Regarding the status of community participation, 74% of survey respondents and majority of the interview respondents replied that they have never participated in restoration activities.
- Regarding the importance of community participation in restoration activities against without community participation, all of interview and survey respondents replied that, restoration activities with community participation is important.

4.5.1. Interpretation and Discussion

This study tried to show as to what types of environmental impact occurred due to the construction activities of the GIBE III HEP dam project which were observed in and around the project site. As well as the study also tried to identify the type and level of restoration practiced carried out by the project after the completion of the construction activities and how effective its management system was.

As can be seen from the study, the project construction activities resulted in various types of environmental impact up on the area. Moreover, those affected type of environmental factors were not satisfactorily restored that commensurate with the level of the impact. This happens while there is an enabling legal environment in the country to put in place and ensure its realization.

The study further indicates that the community under study has knowledge as to what environmental degradation means and its effect. In addition, the communities were well aware of the benefit of participating in restoring the damaged environment. It can also be understood from this that community members around the project site were cooperative if they were mobilized.

The finding from this study also tried to indicate that the project has not emphasized in restoring the most severely affected environment except implementation of HIV/AIDS prevention activities. This is because the intervention started during the construction period and some activities continued after the project completion by already formed youth clubs and health centers. This means that these activities do not demand the project presence in the area implying that the lesson could have been taken and applied to other types of restoration activities as well. Discussion on each category is presented here under.

Ecosystem Impact and its restoration

The issue of ecosystem impact caused by construction activities has been commonly underlined by previous research work of Zolfagharian,et al(2012), Dietz,et al (2001), Shen et al (2005). According to the findings of this research, deforestation, wastes, soil erosion and loss of wildlife were among impacts caused by GIBE III HEP dam project. The data analyzed using survey questionnaire, interview and observation shows that the impacts on this category was significant with high impact of deforestation and waste production low in this category. Looking at restoring these impacts, waste removal has high RII value of nearly 0.8, which indicates well restored and soil erosion control low. This shows that the project was well managed in both waste production and its removal.

Natural resource impact and its restoration

In most cases construction site preparation is the major cause of impacts on natural resource as most physical resources were damaged during this time (Zolfagharian, et al (2012). The study conducted by Diatz, et al (2001) and Macozoma (2012) also emphasized the construction activities impact on natural resource. In this research, the finding on impacts on this category shows that the high impact due to the construction of the dam project was dangerous excavation with RII value of nearly 0.8 and less in Change of landscape which is 0.45 value of RII. However, effort restoring the dangerous excavation sites was minimal having RII value of 0.3 which is very low.

Public health Impact and its restoration

Studies indicate that prevalence of communicable diseases and social disruption are among the adverse impact of both construction and post-construction phase of projects. (Tam. et al, 2004 and Li et al.2010). Similarly, the finding of this research similarly shows that HIV/AIDS prevalence was high in post-project phase with high RII value of nearly 0.9. Similarly restoring this public health impact can be said that successful with a value of RII 0.9.

In general, while deforestation, soil erosion and dangerous excavations were highly impacted environmental factors (in survey result, index value and interview), restoration of these impacts was given less attention. On the other hand, impacts like waste production and HIV/AIDS prevention were well restored by the project management.

The other point that can be seen from the study is that the employer has mainly focused on follow up and taking over of the dam and its operation only and its monitoring of the restoration of damaged environment is ignored. The researcher anticipates the reason for this

to lack of understanding of the meaning of project in its entirety encompassing the environment in general was limited by the employer.

CHAPTER FIVE CONCLUSION AND RECOMMENDATION

5.1. Conclusion

Based on this case study, the identified environmental impacts caused by the construction activities of GIBE III HEP dam project are of various kinds i.e., ecosystem, natural resource and public health impact and severe. However, the implementation of environmental restoration during post-construction phase has not been sufficiently carried out in the areas of identified environmental impacts occurred in the study area. This is due to lack of having clearly stated restoration goals, objectives, detailed implementation plan, established monitoring & follow up system in lieu with existing legal frameworks on the part of the project employer and contractor as well.

The fact that identification of possible environmental impact of the project supported by the EIA report is useful for effective restoration management was not seen in the case of GIBE III HEP dam project. Not only has this but also absence of legally binding statement in project contract agreement document that makes the contractor accountable can be attributed to gaps in restoration management.

An important lesson can be taken from the way how HIV/AIDS prevention and waste removal were well implemented restoration practice in that working closely with stakeholders and affected communities not only help for successful implementation but also ensuring environmental sustainability.

Therefore, lesson can be drawn from this study is that in any construction mega projects due attention has to be given for restoration of environmental impacts possibly occurred as is given to pre design and during construction phase. Moreover, effective restoration has to be supported by law enforcement elements that entail accountability in all concerned bodies.

Responsible governing bodies need to enforce the application and adherence of EIA at project level. In addition, system has to be established to ensure that the construction projects contract agreement include environmental and public health issues. For this end, government structures at all level and the affected communities need to be empowered in decision making process in matters affecting their environment.

5.2. Recommendations

On the basis of findings of this study, the following recommendations for actors involved in construction projects and stakeholders;

5.2.1 Recommendation for EPA

- The EPA need to have a structure that directly supervise and follow the environmental protection issues rather than delegating in such big projects
- The EPA need to establish effective monitoring & evaluation and quality assurance system so that the project it has approved after ESIA takes care of the environment in post-construction period
- The EPA is recommended to establish a system that enables the local governments to oversee and take part in issues regarding environmental protection.

5.2.2 Recommendation for EEPCo

- The employer of GIBE III HEP dam project (EEPCo) need to specifically include legally binding statement regarding the issue of post-project environmental restoration activities which makes the contractor accountable as the case with the operation of the dam during commissioning.

- The employer has to also ensure that the takeover of the project includes the healthy state of the environment after the completion of the project in to consideration.

5.2.3 Recommendation for the Contractor

- The contractor of the GIBE III HEP dam project is recommended to develop the environment management plan that specifically addresses not only environmental protection during the construction period but also restoration of the damaged environment due to its operation after completion or post-project phase.
- The contractor is also recommended that it needs to use the ESIA report and its own study to identify the possible environmental damage of the construction activities for effective implementation of post-project restoration activities
- The contractor is also recommended to create community participation platform in post-project restoration activities for effective site management and environmental sustainability.

Finally, it is recommended that researches need to be carried out to assess the environmental impact of GIBE III HEP dam project construction activities up on specific factors of the environment.

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