

Comparative Analysis of Environmental Protection Provisions in Construction Procurement: A Case Study of Nepal's Projects Funded by National and International Agencies

Sagar Acharya^{1,*}, Subash Kumar Bhattarai², Pratik Khanal³, Preju Khanal⁴, Diksha Dahal⁵

¹Research Scholar, Department of Civil Engineering, Himalaya College of Engineering, Nepal, sasagar617@gmail.com

²Visiting Faculty-Construction Management, Department of Civil Engineering, Kathmandu Engineering College and Department of Civil Engineering, Himalaya College of Engineering, Nepal, subashkbhattarai@gmail.com

³Research Scholar, Department of Civil Engineering, Himalaya College of Engineering, Nepal, khalpratik55@gmail.com

⁴Civil Engineer, Kathmandu Metropolitan City, khnl.preju@gmail.com

⁵Research Scholar, Department of Civil Engineering, Kathmandu Engineering College, Kalimati, drdahal49@gmail.com

Abstract

This study investigates the environmental protection provisions embedded in procurement processes of construction projects in Nepal, funded by various national and international agencies. The research aims to compare and analyze the environmental safeguarding measures outlined in bidding documents from different funding sources, along with examining relevant legal frameworks and policies governing environmental protection in construction projects. Through a qualitative approach and content analysis methodology, the study delves into the scope, limitations, and significance of environmental considerations in construction procurement. Findings reveal diverse approaches across funding agencies, highlighting the emphasis on contractor responsibilities, safety measures, and project management. While Nepal's standard bidding documents establish foundational environmental provisions, projects funded by international agencies demonstrate a higher commitment to environmental sustainability. The study underscores the importance of comprehensive environmental measures in construction projects to mitigate ecological impact and promote long-term environmental conservation.

Keywords: Environmental Protection, Construction Procurement, Comparative Analysis, Nepal, National, and International Agencies

1. Introduction

Construction processes and related activities have significantly aided in environmental pollution and degradation of the environment, deforestation, and other environmental issues. Construction operations have a negative influence on the environment because of waste creation, consumption of resources, noise pollution, air pollution from construction dust, and foul odors from huge diesel-powered construction equipment and vehicles used for transporting materials (Kaja & Goyal, 2023). Construction activities involve the consumption of various forms of resources including raw and finished materials that are derived from various sectors of the environment. The impact of these activities on the environment cannot be over-emphasized (Oke, et al., 2019).

The construction industry's significant consumption of natural resources, accounting for approximately 60% of global usage, raises pressing sustainability concerns (Vieira, et al., 2016). These include its substantial contribution to global warming through carbon dioxide emissions from fossil fuel combustion and concrete production. Additionally, construction activities lead to biodiversity loss and habitat destruction, particularly through land consumption and resource extraction. (Vieira, et al., 2016) Industry also contributes to

acidification through the release of sulfur and nitrogen compounds, leading to acid rain, while airborne particles generated during construction operations contribute to air pollution. Toxic heavy metals from the manufacturing and transportation of construction materials further exacerbate environmental toxicity, impacting both air and water quality. Moreover, water resources suffer from pollution due to construction waste disposal and excessive consumption, disrupting the hydrological cycle. (Jun & Zhihui, 2014) Finally, the industry's expansion necessitates deforestation, threatening biodiversity and the crucial role forests play in ecosystem health. Addressing these issues requires a comprehensive understanding and adoption of sustainable construction practices to mitigate environmental impacts and promote long-term ecological stewardship. (Neenu, 2023)

1.1 Objective of the study

The overall objective of the study is to compare the Environmental Protection provisions laid in the procurement process of construction projects in Nepal funded by various national and international agencies.

1.3 Scope and Limitation of Study

The scope of the study is the examination of environmental protection provisions in the procurement processes of construction projects in Nepal. Similarly, a comparison of provisions across projects funded by different national and international agencies has been carried out along with the analysis of relevant legal frameworks, guidelines, and policies governing environmental protection in construction projects.

The limitations of the study are the availability and accessibility of procurement documents and related information from various agencies. A sample of published bidding document of each donor agency has been taken for the study which might compromise the reliability of data and information. There are constraints in accessing detailed project reports and implementation records as the review of documents is only carried out. There might be potential biases in the interpretation of data and findings.

1.4 Significance of Study

This article offers insights into the efficiency and sufficiency of environmental protection measures that are implemented in construction projects around the world. It also provides direction for improving environmental sustainability and ensuring compliance with rules and assists in the identification of deficiencies and areas that could be improved in the procurement procedures that are associated with environmental protection. Lastly, this also contributes to achieving Nepal's sustainable development goals and contributes to the conservation of the environment.

2. Literature Review

Concept of Environment protection in the construction industry

The term sustainable development was first coined in the Brundtland report of 1987, which defined the three dimensions of sustainability: environment, society, and economy (EnvironmentalScience.org, 2021). This report was a turning point in sustainability discourse, as it focused more on achieving social and economic goals, and their connection to environmental goals, particularly in developing countries

The history of environmental conservation within the construction sector has its roots in the acknowledgment of the industry's substantial ecological impact and the necessity for sustainable development approaches. Over time, the concept of environmental protection has undergone significant evolution, influenced by various pivotal moments:

1. Early Recognition (Pre-20th Century): Environmental concerns were not prominent in construction practices before the 20th century, as the focus primarily centered on maximizing economic efficiency amid rapid urbanization and industrialization. (Golden, 1954)
2. Rise of Environmental Awareness (20th Century): The 20th century witnessed the emergence of environmental movements and heightened public consciousness regarding ecological issues. Events such as

Rachel Carson's publication of "Silent Spring" in 1962 catalyzed widespread concern about pollution and conservation efforts (Griswold, 2012).

3. Governmental Regulations (Late 20th Century): Governments began enacting environmental legislation, including regulations like the U.S. National Environmental Policy Act (NEPA) of 1969 and the Clean Air Act of 1970, which established standards for environmental impact assessments and air quality control within the construction industry. (U.S. Environmental Protection Agency, 2020,)

4. Global Cooperation (Late 20th Century – Present): International agreements such as the United Nations Framework Convention on Climate Change (UNFCCC) established in 1992 underscored the global scope of environmental issues, prompting coordinated efforts to reduce greenhouse gas emissions and combat climate change, thereby influencing construction practices worldwide. (U.S. Environmental Protection Agency, 2020,)

5. Advent of the Green Building Movement (Late 20th Century - Present): The late 20th century saw the rise of the green building movement, advocating for sustainable construction practices aimed at minimizing environmental impact throughout a building's lifecycle. Initiatives like the Leadership in Energy and Environmental Design (LEED) certification system introduced in 1998 provided guidelines for constructing and operating environmentally friendly buildings. In Nepal, environmental protection within the construction industry is a relatively new focus due to ongoing challenges like poverty, political instability, and natural disasters. However, recent initiatives, particularly the Environment Protection Act of 2019 (2076) and the Environment Protection Rules of 2020 (2077), signify progress. These replaced older regulations from 1996 and 1997 and aim to promote sustainable development, environmental conservation, and public involvement in construction and related sectors. The legislation outlines roles for government bodies, including the Environment Protection Council and the Department of Environment, and assigns responsibilities to ensure compliance. Additionally, the act and rules establish procedures and standards for conducting environmental impact assessments (EIAs) and initial environmental examinations (IEEs) for various construction projects while delineating penalties for non-compliance (Maharjan, 2021).

Environment Protection Act and Regulations:

The Environment Protection Act (EPA), implemented in Nepal in 2019, replaces an earlier law and focuses on regulating environmental impacts, particularly in construction projects. It mandates environmental study reports for certain proposals and introduces concepts like environmental management plans and strategic analysis.

This defines the right to live in a clean environment as one of the fundamental rights of its citizens (Article 30). Article 30 (3) confirms a proper balance between environment and development in the development works of the nation. Article 51 f (2) calls for the development of environmentally friendly and sustainable infrastructure. Article 51 g (1) states to protect, promote, and make sustainable use of natural resources. Also, Article 51 g (7) stresses the adopt appropriate measures to abolish or mitigate existing or possible adverse environmental impacts on nature, environment, or biological diversity. Proceeding from and conformable to the Constitution, the Government of Nepal has passed a series of environmental 4 laws and policies and implementing regulations and standards. These legislations that provide the framework within which the environmental assessment is carried out in Nepal are presented in the following Table 2.1. (GoN, 2020) The subprojects (individual WCSCSCs and rehabilitation centers) selected for implementation under the Project shall comply with these environmental laws, rules, standards, and guidelines while preparing, monitoring, and reporting environmental safeguards of the project. (GoN, 2020). All the Environmental Policies and Legal Provisions directing to protect the environment are mentioned below

The Fifteenth Plan Fiscal Year 2019/2020–2023/2024 emphasizes:

- Utilization of local skills and resources for project formulation and construction
- Generating employment opportunities
- Minimizing impacts of climate change

- Protecting the environment
- Integrating disaster risk management into development activities

National Environmental Impact Assessment Guidelines, 1993:

- Provides guidance on environmental mitigation measures for various project activities

Climate Change Policy, 2011:

- Focuses on climate adaptation and disaster risk reduction
- Promotes low-carbon development and climate resilience
- Includes access to financial resources and capacity building

National Water Supply and Sanitation Policy, 1993:

- Includes monitoring of water quality supplied to specific areas

Wastewater Management Policy, 2006:

- Aims to improve sanitary conditions and reduce morbidity
- Establishes guidelines for wastewater management and financing

Environment Protection Act, 2019:

- Mandates environmental assessment for development projects
- Sets pollution control measures and conservation provisions

Environment Protection Rule 2020:

- Defines requirements for conducting environmental impact assessments
- Lists projects requiring Initial Environmental Examination (IEE) or Environmental Impact Assessment (EIA)

Solid Waste Management Act, 2068–2011:

- Assigns responsibilities for solid waste management
- Mandates reduction of waste at source and proper disposal

Solid Waste (Management and Resources Mobilization) Rules, 2013:

- Empowers local bodies for solid waste management

Lands Reform Act, 2021–1964:

- Modernizes land inventories and management

Land Acquisition Act, 1977 and Land Acquisition Rules, 1969:

- Specifies procedures for land acquisition and compensation

Land Acquisition, Resettlement, and Rehabilitation Policy, 2015:

- Focuses on minimizing land loss impacts and improving livelihoods

Labor Act, 2017:

- Provides regulations for labor hiring and safety measures

Child Labor (Prohibition and Regularization) Act, 2001:

- Prohibits child labor in risky activities

Building Act, 2055 BS:

- Regulates building construction for safety

Forest Act, 1993:

- Ensures sustainable use of forest resources

Ancient Monument Prevention Act, 1956:

- Regulates construction near preserved monuments

National Park and Wildlife Conservation Act, 1973:

- Protects wildlife and prohibits trespassing in park areas

Soil and Watershed Conservation Act, 1982:

- Prohibits activities that may harm protected watershed areas

Explosive Material Act, 1962:

- Requires approval for purchasing and using explosives

Local Government Operation Act, 2017:

- Grants local governments legislative, executive, and judicial rights

Nepal National Building Code, 2060:

- Sets standards for building construction and safety

National Drinking Water Supply Standard, 2006:

- Specifies quality standards for drinking water

Nepal Ambient Air Quality Standards, 2012:

- Sets limits for ambient air quality parameters

Nepal Noise Standards, 2012:

- Specifies noise levels for different land use categories and equipment. (PPMO, 2021)

3 Methodology

3.1 Research Design and Approach

For the comparative analysis between the environmental protection in the bidding documents of the various agencies, various literature, and articles (published as well as unpublished) were reviewed. The primary data were collected from online sources and secondary data from published research. The approach of the research is qualitative, and the methodology used is content analysis.

3.3 Study Area, population, and sample size

The study area is Nepal and comprised of bidding documents that have been published by various agencies including the government of Nepal. The data has been collected from the government portal bolpatra.gov.np. A purposive sampling of the bidding documents of each of the funding agencies were taken for the study.

3.5 Methods of Data Collection

The content written in the bidding document under the provision of environmental protection and health and safety is the primary data for the study which has been collected from bolpatra.gov.np. At the same time, secondary data has been collected from published sources.

3.6 Data Analysis and Interpretation

After collecting data from the primary sources, the content analysis was done, and the output was interpreted in narration. Content analysis is a research tool used to determine the presence of certain words, themes, or concepts within some given qualitative data (i.e. text). Using content analysis, researchers can quantify and analyze the presence, meanings, and relationships of certain words, themes, or concepts. (<https://www.publichealth.columbia.edu/>, n.d.).

The content analysis has been further analyzed using the word count and word cloud method. The word count has been done to find out the “keywords” as mentioned in the procurement document. Word count is the number of words in a document, piece of writing, or text. It is a basic metric that measures the frequency of the word repeated in a report (<https://monkeylearn.com>, n.d.)

Further, Word Cloud has been prepared to highlight the major keywords having higher frequency. Word clouds, also known as word trees, are visual representations of text data, with the size of each word indicating its frequency or relevance in the text. These visualizations are made with software tools that analyze the frequency of words in each text and depict them graphically. Word trees are frequently used in data visualization, content analysis, and text-mining applications (<https://boostlabs.com/>, n.d.). They give a fast overview of the most important words in a document and can assist in uncovering patterns, themes, or trends.

4. Results and Discussions

The comparative analysis started with the analysis of the provisions laid in the bidding document of the government of Nepal and the bidding document of various donor agencies. The provisions of each of them have been separately analyzed and compared. The content analysis of word count and world cloud depicted the keywords in the provisions.

4.1 Environmental protection, health, and safety Provisions in Standard Bidding Documents of Nepal

Nepal's Public Procurement Monitoring Office (PPMO) has taken proactive measures to integrate environmental protection into its standard bidding documents. These provisions encompass an array of considerations, including safety protocols, erosion control measures, waste disposal guidelines, and wildlife protection strategies. (PPMO, 2021) Contractors are not only encouraged but mandated to adhere to these provisions rigorously throughout the project lifecycle to effectively mitigate the environmental impacts associated with construction activities.

Provision of Environment in Standard Bidding Document of Nepal

- **Safety Consideration:** The Contractor is required to prioritize the safety of all individuals present on the site and maintain the site and works in an orderly state to prevent any potential dangers.
- **Safety Infrastructure:** The Contractor must, at their own expense, provide and maintain lights, guards, fencing, warning signs, and supervision as needed for the protection of the works, ensuring safety and convenience for the public and others.
- **Environmental Protection:** The Contractor is obligated to take reasonable measures to protect the environment on and off the site, avoiding damage or nuisance to persons, the community, and public or private property from pollution, noise, or other causes resulting from their operations.
- **Erosion Control:** The Contractor must promptly plant cut or fill slopes with grass or other plant cover to prevent erosion.
- **Waste Disposal:** Any material removed from drains must be disposed of in designated stable tipping areas as directed by the Project Manager.
- **Fuel Use:** The Contractor is prohibited from using fuel wood for heating during the processing or preparation of materials forming part of the works.

- Wildlife Protection: The Project Manager has the authority to disallow or modify any working practice or activity of the Contractor if it is deemed harmful to wildlife, based on advice from relevant government departments.
- Safety Equipment and First Aid: The Contractor must provide lifesaving apparatus and maintain an easily accessible first aid outfit on the site, according to government ordinances, factory acts, and other relevant regulations.

The word cloud of the document using content analysis is presented in figure 1.

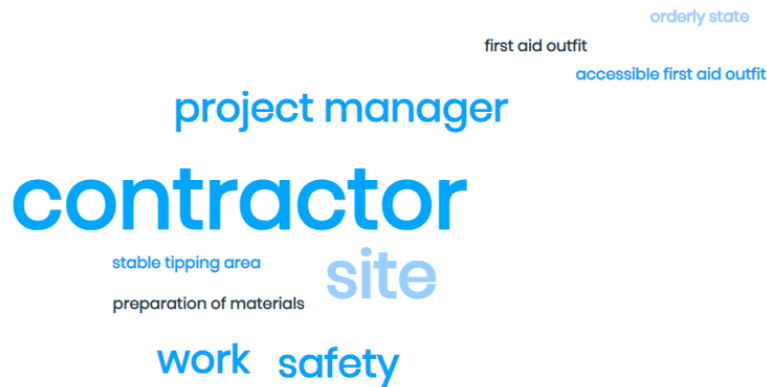


Figure 1. World cloud of PPMO's SBD Environmental protection, health, and safety Provisions

Analysis of the Data

High Frequency and Relevance

Contractor (Count: 7, Relevance: 1): The term "contractor" appears most frequently, with the highest relevance score of 1. This indicates that contractors are a critical component in the context being analyzed, possibly central to the operations or discussions within this dataset.

Moderate Frequency and Relevance

- Site (Count: 4, Relevance: 0.56): The word "site" appears four times with a relatively high relevance score, suggesting that the physical location or site is an important aspect of the context.
- Project Manager (Count: 2, Relevance: 0.31): Mentioned twice with a moderate relevance, the role of a project manager is also significant, though not as central as contractors.
- Safety (Count: 2, Relevance: 0.26) and Work (Count: 2, Relevance: 0.26): Both terms are equally mentioned and have the same relevance, highlighting the importance of safety and work in the context.

Low Frequency and Relevance

- Accessible First Aid Outfit (Count: 1, Relevance: 0.2): This phrase, mentioned once, has a slightly higher relevance score than other low-frequency terms, indicating a particular focus on the accessibility of first aid equipment.
- Stable Tipping Area (Count: 1, Relevance: 0.18): Stability in the working area, specifically relating to tipping, is noted once, pointing to concerns about maintaining safe and stable conditions.
- First Aid Outfit, Orderly State, Preparation of Materials (Each Count: 1, Relevance: 0.16): Each of these terms appears once with the lowest relevance scores in the table. They likely reflect specific aspects or considerations within the broader context.

Discussions:

- Key Focus Areas: The high frequency of the word "contractor" suggests that contractors are the main focus, possibly reflecting a study or report on their role, performance, or issues within a project or

construction environment. The “site” is also a significant focus, which is typical in discussions about construction or project management where the location plays a crucial role.

- **Roles and Safety:** The mention of "project manager" and "safety" emphasizes the importance of leadership and health precautions. Project managers are vital for overseeing operations, while safety is a core concern in any project.
- **Specific Considerations:** The less frequently mentioned terms still hold relevance, highlighting particular aspects such as the need for accessible first aid and stable working conditions, which are essential for maintaining a safe working environment.
- **Comprehensive Overview:** The variety of terms, despite their differing frequencies and relevance scores, collectively provide a comprehensive overview of the critical components and considerations within the analyzed context. This might include roles (contractor, project manager), key concerns (safety, work), and specific requirements (first aid, orderly state, stable areas).

The data indicates a strong emphasis on contractors and the site, underlining their primary importance. Other roles and safety measures also play significant roles, and specific considerations around first aid and stability highlight the nuanced aspects of managing such environments. Understanding the distribution and relevance of these terms can help prioritize focus areas and address key concerns effectively within the context of project management or construction.

4.2 Environmental protection, health, and safety Provisions in Standard Bidding Documents of various agencies:

World Bank:

From the study of the project as annexed below listed were the provisions laid in the conditions of contract (PPMO, 2023)

- **Contractors' Environmental and Social Management Plans (C-ESMP):** The World Bank mandates that contractors develop detailed C-ESMPs based on project instruments and obtain approval from project managers before commencing any civil works or pre-construction activities. These plans outline specific measures to mitigate environmental and social impacts throughout the project lifecycle.
- **Environmental Compliance:** Contractors are responsible for ensuring that emissions, surface discharges, solid waste, and effluent from their activities do not exceed specified values or violate applicable laws. They must erect signage at critical locations for safety.
- **Construction Site Security:** Construction sites in built-up areas and along traffic routes should be fenced to prevent unauthorized access, with fencing mechanisms requiring approval from project managers.
- **Worker Facilities:** Standard arrangements for worker quarters, accommodation, food, drinking water, and separate sanitary facilities for male and female workers must be provided at temporary construction work sites.
- **Worker Insurance:** Contractors are required to insure all workers engaged in the construction site against accidents as prescribed.
- **Occupational Health and Safety Measures:** Occupational health and safety measures must be ensured at every construction stage, including material storage, waste disposal, worker accommodations, road user safety, and pollution prevention.
- **Compliance Monitoring:** Regular assessments are conducted to monitor compliance with Environmental, Social, Health, and Safety (ESHS) requirements, including Sexual Exploitation and Abuse (SEA), Sexual Harassment (SH), Occupational Health and Safety (OHS), and Labor camp requirements.
- **Accident Reporting:** Any project-related accidents or incidents must be reported to the Project Manager within 48 hours, including details of immediate actions taken.
- **Worker Records:** Contractors are responsible for maintaining detailed records for the entire workforce and providing them to relevant authorities upon request.



Figure 2. World cloud of WB's project under study on Environmental protection, health, and safety Provisions

Analysis of the Data

High Frequency and Relevance

- Contractor (Count: 4, Relevance: 1): The term "contractor" remains the most frequently mentioned and has the highest relevance score, reinforcing its central importance in the context being analyzed.
- Occupational Health (Count: 3, Relevance: 0.86) and Project Manager (Count: 3, Relevance: 0.86):

Both terms have a high count and relevance, indicating that health considerations in the workplace and the role of project managers are critical components in the dataset.

Moderate Frequency and Relevance

- Construction Site (Count: 2, Relevance: 0.52) and Safety Measure (Count: 2, Relevance: 0.52):
- These terms, with moderate counts and relevance scores, point to the importance of the physical location of construction activities and the measures in place to ensure safety.
- Accident, Approval, Environmental, Safety (Each Count: 2, Relevance: 0.42):

These terms are mentioned equally and have moderate relevance, highlighting various critical aspects such as incident occurrences (accidents), necessary approvals, environmental considerations, and general safety concerns.

Low Frequency and Relevance

- Critical Location for Safety (Count: 1, Relevance: 0.29): This phrase, mentioned once, has the lowest relevance score, suggesting it is a specific but less emphasized aspect of the broader safety considerations.

Discussion

- Key Focus Areas: "Contractor" remains a primary focus, emphasizing its importance in the project or construction environment. The high relevance of "occupational health" and "project manager" highlights the significant roles these elements play in maintaining a safe and efficient working environment.
- Roles and Safety: The repeated emphasis on roles (contractor, project manager) and safety (occupational health, safety measure, accident) underscores the critical balance between managing people and ensuring their safety. The term "occupational health" specifically highlights a focus on the health aspects of workplace safety, which is crucial in preventing long-term health issues.
- Environmental and Regulatory Considerations: The inclusion of "approval" and "environmental" terms points to the regulatory and environmental dimensions of the context, suggesting that compliance and environmental impact are also significant concerns.
- Comprehensive Overview: The data covers a broad spectrum of relevant aspects, from the central role of contractors to specific safety measures and regulatory considerations. The term "critical location for

safety" may refer to specific areas within the construction site that require particular attention to safety protocols.

The data emphasizes the multifaceted nature of managing construction or project environments, with a strong focus on the roles of contractors and project managers, alongside critical safety and health measures. Occupational health and safety measures are highlighted as key priorities, indicating a comprehensive approach to ensuring a safe working environment. The moderate frequency of terms related to accidents, approvals, and environmental concerns suggests these are also important but secondary to the primary focus areas. Understanding the distribution and relevance of these terms helps identify priority areas and ensures a balanced approach to managing both operational efficiency and safety.

Asian Development Bank (ADB):

In the project as annexed funded by Asian Development Bank following special provisions are made in special contract condition:

- Environmental Protection Works: ADB-funded projects emphasize contractor responsibilities in safeguarding the environment during construction, compliance with prevailing pollution laws, prohibition of unauthorized activities like explosives use, and accountability for employee actions.
- Protection of Existing Environmental Conditions: Construction activities should not deteriorate the environment, and reinstatement of borrow pits and dumping sites at the contractor's expense through grass or tree plantation is mandated.
- Written Approval Required for Environmental Protection: Contractors must obtain written approval from engineers for environmental protection and reinstatement throughout the contract period, with non-compliance potentially impacting payments.
- Borrow/Quarry Sites: Engineers have the authority to disallow construction methods or areas that endanger stability or drainage. Measures to prevent erosion, sediment deposition, and concentration of surface water are required.
- Disposal of Spoil and Construction Waste: Excess materials must be disposed of in agreed locations to prevent instability and property destruction, with exposed disposal sites requiring dressing and vegetation planting.
- Provision and Maintenance of Camps, Offices, Stores, and Equipment Yards: Contractors must establish and maintain camps, offices, and stores meeting hygienic and safety standards, with approval required from engineers.
- Provision and Maintenance of Toilets: Toilets and sanitation facilities must be constructed to prevent public nuisance and water/air pollution, with proper sanitation methods and hygiene employed throughout the project.
- Provision of Potable Water: Potable water must be supplied to staff and workers at camps and construction sites to prevent waterborne diseases, with water sources and arrangements communicated to engineers.
- Provision of First Aid/Medical Facilities: First aid and medical facilities for injured/sick workers must be provided, including transportation to hospitals, with engineers informed about facility establishment and operation. (PPMO, 2020)



Figure 3. World cloud of ADB's project under study on Environmental protection, health, and safety Provisions

Analysis of the Data

High Frequency and Relevance

- Engineer (Count: 5, Relevance: 1): The term "engineer" appears most frequently and has the highest relevance score, indicating that engineers are the central focus in this dataset.
- Provision (Count: 4, Relevance: 0.78): The high count and relevance of "provision" suggest that supplying necessary resources or services is a critical component.

Moderate Frequency and Relevance

- Contractor (Count: 3, Relevance: 0.56): The role of contractors remains important, although slightly less central compared to engineers.
- Environmental Protection, First Aid, Potable Water (Each Count: 2, Relevance: 0.42):

These terms, each with a moderate count and relevance, highlight key operational and safety concerns. Environmental protection suggests a focus on sustainable practices, while first aid and potable water underscore health and safety provisions.

Lower Frequency and Relevance

- Approval, Camp, Environment, Maintenance (Each Count: 2, Relevance: 0.34):

These terms, mentioned twice and with lower relevance scores, likely represent logistical and regulatory aspects of the operation. "Camp" might refer to worker accommodations, and "maintenance" to the upkeep of equipment or facilities.

Discussion

- Key Focus Areas: The shift in focus from contractors to engineers indicates that this dataset might be centered more on the technical and operational side of projects, where engineers play a pivotal role. Provisions are also emphasized, suggesting that ensuring the availability of necessary resources is a key operational concern.
- Safety and Environmental Considerations: The inclusion of "environmental protection" alongside "first aid" and "potable water" underscores a balanced approach to both environmental sustainability and worker safety. These considerations align with broader industry trends towards prioritizing sustainable practices and ensuring the health and safety of workers.
- Logistical and Regulatory Aspects: Terms like "approval" and "camp" suggest that there are significant logistical and regulatory dimensions to the context. Approvals are likely regulatory or compliance-related, while camps might refer to worker housing, indicating the importance of worker welfare.

The data indicates a strong emphasis on the roles of engineers and the provision of necessary resources, reflecting a focus on the technical and logistical aspects of a project or operation. Safety and environmental concerns are also prominent, highlighting the importance of maintaining sustainable practices and ensuring worker health and safety. The less frequent terms related to approval, camps, and maintenance point to important but secondary logistical and regulatory aspects that support the primary focus areas. Understanding these distributions helps prioritize key areas and ensure a holistic approach to managing operations, balancing technical requirements with safety and environmental considerations.

Kreditanstalt für Wiederaufbau (KfW):

The project as annexed funded by KfW, following special provision are made in the conditions of contract (PPMO, 2023).

- Compliance with International Standards: Contractors must comply with international Environmental, Social, Health, and Safety (ESHS) standards, with subcontractors and major suppliers also required to adhere to these standards consistent with local laws and regulations.
- Environmental and Social Risks Mitigation: Contractors must implement measures identified in environmental and social impact assessments (ESIAs) and environmental and social management plans (ESMPs), including prevention measures for sexual exploitation, abuse, and gender-based violence.
- Safety Measures: Contractors must ensure the safety of all persons on-site and provide and maintain safety measures such as lights, guards, fencing, and warning signs. They must also protect the environment on and off the site, avoiding pollution, noise, and other nuisances.
- Erosion Control and Waste Disposal: Measures to prevent erosion, sediment deposition, and concentration of surface water are required. Disposal of excess materials must be done in approved locations to prevent instability and property destruction, with exposed disposal sites requiring dressing and vegetation planting.



Figure 4. World cloud of KfW's project under study on Environmental protection, health, and safety Provisions

Analysis of the Data

High Frequency and Relevance

- Contractor (Count: 3, Relevance: 1): "Contractor" appears most frequently and with the highest relevance score, indicating its central importance within this context. This term has consistently appeared as highly relevant across different datasets, reinforcing the pivotal role contractors play.

Moderate Frequency and Relevance

- Safety Measure (Count: 2, Relevance: 0.71): Safety measures are crucial, reflecting a significant concern for maintaining safe working conditions.
- Measure, Safety, Site, Standard (Each Count: 2, Relevance: 0.55): These terms, each with moderate counts and similar relevance scores, highlight key operational aspects. "Measure" and "Safety"

emphasize safety protocols, while "Site" and "Standard" likely pertain to the location and regulatory compliance, respectively.

Low Frequency and Relevance

- Concentration of Surface Water (Count: 1, Relevance: 0.29): This term suggests a specific environmental concern, possibly related to drainage or water accumulation issues on the site.
- Social Impact Assessment, Social Management Plan, Social Risks Mitigation (Each Count: 1, Relevance: 0.23): These terms reflect social considerations, indicating efforts to assess and manage the social implications of the project, as well as strategies to mitigate any associated risks.

Discussion

Key Focus Areas:

- Contractors: The high relevance of "contractor" reiterates its critical role in the project, likely responsible for executing key tasks and ensuring project completion.
- Safety: The emphasis on "safety measure," "measure," and "safety" highlights a strong focus on maintaining safe working environments, which is crucial in any construction or project management context.
- Site and Standards: The terms "site" and "standard" suggest a focus on the physical location and adherence to established regulations and guidelines, ensuring that operations meet necessary compliance standards.

Environmental and Social Considerations:

- Environmental: The mention of "concentration of surface water" points to specific environmental management issues that need addressing, likely to prevent flooding or water-related damage.
- Social: The presence of terms related to social impact assessment, management plans, and risks mitigation indicates a proactive approach to understanding and managing the project's social impact. This reflects a broader industry trend towards considering the social dimensions of projects.

The data underscores the importance of contractors and safety in project management, reflecting consistent themes from previous datasets. Safety measures, site management, and adherence to standards are central concerns, ensuring both compliance and operational efficiency. The specific mention of environmental and social aspects highlights a comprehensive approach to project management that includes addressing potential environmental impacts and understanding the social implications. This balanced focus helps ensure not only the successful completion of the project but also the well-being of the workers and the community, aligning with broader industry practices of sustainability and social responsibility.

Department for International Development (DFID) (Now named as FCDO):

In the project as annexed financed by FCDO, some special conditions regarding the environment are as below:

- Development of Detailed Plans:

DFID projects necessitate the development of Environment Management Plans (EMPs), Health & Safety Plans, and Job Layout Plans. These plans outline measures to mitigate environmental impacts, ensure worker safety, and organize construction activities efficiently.

- Environment Management Plan (EMP):

EMPs include strategies for controlling air and dust pollution, noise pollution, land and water pollution, disturbance to hospital operations, vibration, traffic congestion, waste material disposal, and impacts on public utilities and social concerns.

- Health and Safety Plan:

Health and Safety Plans focus on ensuring workers' safety through mandatory safety gear, insurance coverage, and the provision of first aid facilities.

- Job Layout Plan:

Job Layout Plans determine the layout of construction sites, including cordoning off construction areas, erecting barriers, and implementing approved fencing mechanisms.

- Compliance with the Labor Act 2017 of Nepal:

DFID projects mandate adherence to provisions outlined in the Labor Act to protect workers' rights and promote fair labor practices (PPMO, 2019)



Figure 5. World cloud of FCDO's project under study on Environmental protection, health, and safety Provisions

Analysis of the Data

High Frequency and Relevance

- Job Layout Plan (Count: 2, Relevance: 1): The term "job layout plan" appears most frequently with the highest relevance score, indicating that planning the layout of jobs is a central focus. This likely involves the detailed organization of tasks and resources on the construction site.
- Safety Plan (Count: 2, Relevance: 0.87): Safety plans are also crucial, reflecting a significant emphasis on outlining protocols and measures to ensure workplace safety.

Moderate Frequency and Relevance

- EMP (Count: 2, Relevance: 0.67) and Health (Count: 2, Relevance: 0.67): The acronym "EMP" stands for "Environmental Management Plan," highlighting the importance of managing environmental impact. The focus on health underscores the priority of worker well-being.

Low Frequency and Relevance

- Development of Environment Management Plans (Count: 1, Relevance: 0.33), Layout of Construction Sites (Count: 1, Relevance: 0.33): These terms suggest detailed planning for environmental management and the physical organization of construction sites, though they are mentioned less frequently.
- Environment Management Plan (Count: 1, Relevance: 0.27), First Aid Facility (Count: 1, Relevance: 0.27), Job Layout Plans (Count: 1, Relevance: 0.27), Mandatory Safety Gear (Count: 1, Relevance: 0.27): These terms, with low counts and relevance scores, still represent important aspects. They include specific planning and safety measures, as well as the provision of first aid facilities and required safety gear.

Discussion

Key Focus Areas:

- **Job Layout Planning:** The high relevance of "job layout plan" indicates its critical role in organizing construction projects efficiently. Effective job layout planning ensures optimal use of space, resources, and personnel.
- **Safety and Health:** The importance of "safety plan" and "health" reflects a strong emphasis on maintaining safe and healthy working conditions. This is crucial in preventing accidents and promoting worker well-being.
- **Environmental Management:** The terms related to environmental management (EMP, development of environment management plans) underscore the significance of sustainable practices and compliance with environmental regulations.

Specific Considerations:

- **First Aid and Safety Gear:** The mention of "first aid facility" and "mandatory safety gear" points to the practical measures taken to ensure safety on the construction site. These facilities and gear are essential for immediate response to injuries and for preventing accidents.
- **Planning and Compliance:** The focus on developing and implementing plans (job layout, safety, and environmental management) indicates a comprehensive approach to project management. This involves detailed preparation and adherence to standards to ensure both efficiency and compliance with regulations.

The data emphasizes the critical importance of detailed planning in job layouts and safety, reflecting central themes of effective project management. The significant focus on safety and health plans indicates a commitment to maintaining safe working conditions and promoting worker health. Environmental management is also a key concern, highlighting the importance of sustainable practices and regulatory compliance. Specific considerations like first aid facilities and mandatory safety gear further underscore the practical measures taken to ensure worker safety. Understanding these distributions helps prioritize areas that ensure a well-organized, safe, and environmentally compliant construction site, aligning with best practices in the industry.

4.3 Comparative Analysis of Environmental Provisions by International Funding Agencies:

Comparative summary of the similarities and differences among the standard bidding documents (SBDs) from the Government of Nepal (GoN), World Bank, Asian Development Bank (ADB), KfW (German Development Bank), and the Foreign, Commonwealth & Development Office (FCDO):

Similarities in the document

Contractors and Engineers

- **Contractors:** All SBDs emphasize the critical role of contractors, reflecting their central position in project execution.
- **Engineers:** Mentioned explicitly in ADB's SBD, indicating their importance in technical and operational aspects.

Safety and Health

- **Safety Measures:** Safety is a recurrent theme across all SBDs, with frequent mentions of safety plans, safety measures, and first aid facilities.
- **Health:** Health and occupational health are highlighted, showing the importance of worker well-being.

Environmental Management

- **Environmental Protection:** Environmental management and protection are consistently mentioned, emphasizing sustainable practices and regulatory compliance.

Planning and Management

- Job Layout and Site Management: Planning, including job layout plans and site management, is a common focus, ensuring efficient organization of tasks and resources.

Differences in the document

Role Emphasis

- GoN: Strong focus on contractors and site management, with less emphasis on social impacts.
- World Bank: Holistic approach with significant emphasis on safety, health, environmental management, and social impacts.
- ADB: Emphasis on engineers and logistical provisions, alongside environmental protection and safety.
- KfW: Balanced focus on planning, safety, environmental, and social management.
- FCDO: Detailed planning and comprehensive safety measures, with strong health and safety considerations.

Social Considerations

- World Bank and KfW: Explicit mention of social impact assessment, social management plans, and social risks mitigation.
- GoN, ADB, FCDO: Less explicit focus on social impacts compared to World Bank and KfW.

Logistics and Specific Measures

- ADB: Focus on logistical provisions such as potable water and camp facilities.
- FCDO: Specific mention of mandatory safety gear and first aid facilities.
- GoN and World Bank: More generalized focus on safety and operational measures without detailed logistical mentions.

Regulatory Compliance

- World Bank and KfW: Strong emphasis on obtaining approvals and adhering to standards.
- GoN, ADB, FCDO: Mention regulatory compliance, but not as prominently as the World Bank and KfW.

The analysis of SBDs from GoN, World Bank, ADB, KfW, and FCDO reveals both commonalities and unique emphases:

Commonalities:

All organizations prioritize contractors, safety, health, and environmental management. Planning and site management are critical across all SBDs, ensuring efficient and safe project execution.

Differences:

- Role Emphasis: Varies from a strong focus on contractors (GoN) to engineers (ADB).
- Social Impact: Explicit in World Bank and KfW SBDs, less so in others.
- Logistics: Detailed in ADB and FCDO, with specific provisions and safety measures.
- Regulatory Compliance: Prominently emphasized by World Bank and KfW.

These similarities and differences reflect each organization's priorities, operational context, and approach to project management, ensuring a comprehensive understanding of their SBDs.

5. Conclusion

Each organization's SBD reflects its priorities and approaches to project management. Government of Nepal focuses heavily on the role of contractors and ensuring safe and well-managed construction sites. While there

are mentions of environmental concerns, the primary focus remains on operational and safety aspects. The World Bank significant emphasis on safety, health, and environmental management, alongside a notable consideration for social impacts. This reflects a holistic approach to project management that integrates technical, environmental, and social dimensions. ADB's emphasizes the technical and logistical aspects of projects, with engineers playing a pivotal role. Environmental protection and safety are also prioritized, ensuring that operational logistics are well-managed. KfW's SBD highlights the importance of detailed planning and safety measures, along with a balanced approach to environmental and social management. The focus on site layout and standards ensures that projects are well-organized and compliant with regulations. FCDO places a strong emphasis on detailed job layout planning and safety, integrating health considerations and environment management plans. The specific mention of safety gear and first aid facilities indicates a thorough approach to ensuring worker safety and well-being.

The comparative summary reveals a consistent emphasis on key areas such as contractors, safety, and environmental management across the datasets. The focus on safety and health underscores their paramount importance, while the varying emphasis on roles (engineers vs. contractors) and social impacts highlights different facets of project management priorities. Detailed planning and logistical considerations are essential for efficient and compliant operations, aligning with best practices in the industry. Understanding these similarities and differences helps prioritize key areas and ensure a balanced approach to managing construction projects, emphasizing safety, efficiency, and sustainability.

The imperative of environmental protection in construction projects cannot be overstated, particularly in the context of sustainable development. While Nepal's standard bidding documents lay down foundational environmental provisions, projects funded by international agencies exhibit a higher degree of commitment toward environmental sustainability. By embracing and implementing comprehensive environmental measures, construction projects can significantly mitigate their ecological footprint and contribute meaningfully to long-term environmental conservation and community well-being. Further research and collaborative efforts between stakeholders must be undertaken to enhance environmental protection within the construction sector and advance the overarching goals of sustainable development.

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7. Data Availability

Representative data analyzed during this study are included in the text. The detail dataset generated during and/or analyzed during the current study will be available on reasonable request.

8. Conflict of Interest

The authors declared no conflict of interest.

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