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A CASE STUDY OF BELKHU RIVER OF DHADING DISTRICT IN NEPAL: ASSESSMENT OF EFFECTIVE EXTRACTION OF CONSTRUCTION MATERIALS FROM RIVER

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ABSTRACT

River sand, gravel, and stones constitute the primary sources of extraction of materials for infrastructure and economic development. However, any activity involving excessive extraction of material resources without proper regulation and management may result in environmental degradation, instability of rivers and imbalances in the ecosystem. The purpose of this paper is to review the efficiency of the process of extraction of construction material in the Belkhu River, Dhading, Nepal. The practices involved in the extraction process, the environmental impacts of the process, key challenges faced and sustainability strategies are assessed in this paper. In carrying out their study, the researchers used both qualitative and quantitative techniques. Observation, questionnaire administration, focus group discussions, and conducting interviews were among the methods that the authors used. Key respondents included the local communities, managers of crushers, engineers, contractors, and other employees in the area. Secondary data were obtained from different government reports and policies, and previous studies on the subject matter. Poor practices and lack of systematicity of the process have resulted in the following: soil erosion at the banks of the river, instability of river channels, environmental degradation, transportation problems, and lack of overall supervision of the process. The challenges facing efficient extraction activities include poor policy implementation, lack of scientific investigation, inadequate technology, climate change impacts, and shortage of professional personnel.

KEYWORDS: Riverbed materials, Sand mining, Sustainable extraction, Belkhu River, Construction materials, Environmental impact, Nepal.

1. INTRODUCTION

Building materials such as sand, gravel, pebbles, and stones play a crucial role in the creation of infrastructures. With urbanization and construction processes increasing rapidly, the need for materials from river beds has also been escalating in Nepal. The rivers serve as the primary source of aggregates used in building materials because they provide easy access and cost-effective extraction process.

The Belkhu River lies inside the Gajuri Rural Municipality of the Dhading district, which has been identified as an active river system used for material extraction. The practice has brought about economic development to the community via job creation. Overextraction of materials from the river could lead to adverse effects.

Morphological characteristics of the river channel may get affected through such extraction processes. These extraction methods have potential to cause increased erosion along banks of the river and also decrease the biodiversity and equilibrium of sediments within the river bed. Most river beds extraction methods being practiced in Nepal lack necessary geological studies and proper monitoring measures for their sustainability.

In this research, the aim will be focused on evaluation of the riverbed extraction process in Belkhu River.

2. OBJECTIVES OF THE STUDY

The main aims of the study include the following:

1. Evaluation of both the positive and negative effects on the environment caused by extraction of construction materials.
2. Investigation of the current methods of extracting materials from the river bed.
3. Determination of the problems related to river bed material extraction and their causes and effects.
4. Proposal of solutions for efficient extraction of construction materials.

3. Study Area

The experiment was performed on the Belkhu River located within Gajuri Rural Municipality of Dhading district of Bagmati province, Nepal. The river stretches over approximately 7 to 8 kilometers on the Prithvi highway.

Aggregates of sand, gravel, and stones obtained from Belkhu River are used in a wide range of structures including road and building construction. There are numerous aggregate plants within the Belkhu River area.

4. METHODOLOGY

The research adopted both qualitative and quantitative approaches. Primary and secondary data were collected for comprehensive analysis.

4.1 Primary Data Collection

The following methods were used:

- Field Observation (FO)
- Questionnaire Survey (QS)
- Focus Group Discussion (FGD)
- In-Depth Interview (IDI)

Respondents included local residents, crusher operators, laborers, contractors, engineers, transporters, and local government representatives.

4.2 Secondary Data Collection

Secondary data were collected from:

- Published journals and articles
- Government reports and guidelines
- Previous research studies
- Local authority records
- Environmental reports

4.3 Data Analysis

The collected data were analyzed using descriptive and comparative methods. Respondent opinions regarding extraction problems, environmental impacts, and possible solutions were categorized and interpreted.

5. RESULTS AND DISCUSSION

5.1 Existing Extraction Practices

According to the findings, digging activities take place through excavators, loaders, and dump trucks. Digging of sand, gravel, and boulders takes place directly on the riverbed.

Riverine morphological activities take place in selected reaches of the river, hence inconsistency of the morphological nature of the river and its channels. There is intense extraction in the dry season due to accessibility and low volumes of flow.

5.2 Major Problems Associated with Extraction

The study identified several major problems affecting effective extraction of construction materials:

a. Improper Geological Study

Lack of proper geological investigation before extraction leads to unsustainable mining and increased riverbank erosion.

b. Weak Implementation of Laws and Policies

Poor monitoring and weak enforcement of environmental regulations encourage illegal and excessive extraction activities.

c. Insufficient Advanced Technology

Many extraction operators still use outdated methods and equipment, reducing efficiency and increasing environmental damage.

d. Non-Continuous Extraction and Power Supply

Irregular extraction operations and unreliable power supply affect crusher plant productivity and material management.

e. Transportation and Storage Issues

Poor road conditions, long hauling distances, and inadequate storage facilities increase operational costs and reduce efficiency.

f. Climate Change Impacts

Heavy rainfall, floods, and unpredictable weather patterns increase riverbank erosion and affect extraction operations.

g. Poor Health and Safety Measures

Many workers lack proper safety equipment and training, creating occupational health and accident risks.

h. Unsustainable Mining

Over-extraction of riverbed materials disturbs the natural sediment balance and accelerates river degradation.

5.3 Environmental Impacts

a. Positive Impacts

- Supply of raw materials for infrastructure development
- Employment opportunities for local communities
- Revenue generation for local governments
- Improvement of transportation and construction sectors

b. Negative Impacts

- Riverbank erosion
- Channel instability
- Loss of aquatic habitat
- Increased sediment imbalance
- Dust and noise pollution
- Damage to agricultural land and nearby infrastructure

The study revealed that the negative environmental impacts become more severe when extraction activities are conducted without scientific planning and monitoring.

5.4 Suggested Solutions

Some recommendations provided by the respondents and experts regarding effective extraction management include:

1. Geological and environmental analysis prior to extraction.
2. Laws governing extraction activities must be monitored and enforced.
3. Modern technology must be used for extraction processes and material handling.
4. Safety orientation must be provided for the extraction workers.
5. Distance in hauling must be minimized and road construction made more efficient.
6. The quantity of extraction must be controlled based on the rate of natural renewal of sediments.
7. Local government should employ engineers and geologists to make regular analysis.
8. Community participation in river management practices is encouraged.

9. CONCLUSION

Material extraction from the Belkhu River is necessary for development purposes. Nevertheless, the extraction process itself faces numerous challenges due to the unsatisfactory and unscientific manner through which the process is carried out.

In summary, this research demonstrates that poor implementation of policy, inadequate geological survey, inadequate monitoring, impacts of climate change, transportation issue, and inadequate use of technology affect sustainable material extraction. Extraction activities without proper management could cause environmental destruction and the instability of the river. Material extraction can be sustainable by conducting scientific studies on the extraction process, monitoring the extraction process, applying appropriate technology, and involving stakeholders.

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