Chapter 13
Sustainable Mining Waste Management by Eco Logistics

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ABSTRACT

Mining is key to economic growth, but historical mining techniques and the absence of periodic mined-land reclamation, remediation, and restoration have led to significant environmental and human health hazards. New mining methods continue to have major waste impacts that must be addressed during and after carrying out the actual mining operation. Some new operations occur in areas where the actual material contains sufficient residual minerals such that further development, remaining, and subsequent reclamation of the waste are economically viable. By examining multiple factors simultaneously, these methods facilitate minimizing the influence of subjectivity and bias on decisions. Moreover, MCDM method furnishes a framework to evaluate trade-offs between conflicting objectives, permitting decision-makers to navigate through intricate decisions effectively.

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INTRODUCTION

The mining industry is one of the industries that contributes majorly to the gross domestic product (GDP) capita of all mining countries, in India alone, the mining sector contributes at least 3% towards the GDP growth.

However, due to the various mining operations, huge volumes of waste is also generated and this waste must be properly handled. The amount of waste generated is dependent greatly on the minerals resources being mined, the technology applied and the geology of the mining site. There is therefore a need to have effective waste management plans in order to lessen environmental degradation and pollution. The waste management strategies to be adopted must include the waste storage area, its design and long-term sustainable plans for waste minimization post mining closure.

Some current operations even have the infrastructure in place to co-manage the cleanup wastes. Understanding and addressing potential impacts at many of these sites are often complex. Remedial solutions are often time-consuming, uneconomical and unacceptable to the regulated and regulatory communities, as well as to the public.

The essence to success in the evolving mining sector is making sensible decisions. Due to the complexity and multidimensional of mining operations, it is necessary to adopt appropriate decision-making strategies. Multi-Criteria Decision Making (MCDM) is one such method that has gained considerable attention.

Techniques of MCDM provide a systematic approach to decision making by considering multiple criteria, thereby facilitating a more comprehensive evaluation of available alternatives. One of the key benefits of MCDM is its adaptability, as it provides multidimensional techniques that can be adapted to diverse mining scenarios. These methods constitute, among others, the Analytic Hierarchy Process (AHP), the Technique for Order Preference by Similarity to the Ideal Solution (TOPSIS), and the Preference Ranking Organization Method for Enrichment Evaluation (PROMETHEE). Each method has its own distinct benefits, such as its ability to manage both quantitative and qualitative criteria and its speculation of uncertainty and sensitivity analysis.

MCDM methods have a number of applications in the mining and mineral processing industries. First, MCDM assists with mining site selection, allowing companies to identify optimal locations depending on geology, environmental impact, socio-economic factors. MCDM techniques give a comprehensive evaluation of potential mining sites by incorporating these multiple criteria.

Further, MCDM methods can be used to choose and optimize equipment. With a number of mining equipment available, it is essential to make the most appropriate selection in order to optimize productivity, efficiency, and safety. Approaches to MCDM in selecting equipment alternatives depends on criteria such as performance,