A Sustainable Mining Framework: Applying the Environmental Management System in the Province of Zambales

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Abstract

This study, entitled **"**A Sustainable Mining Framework: Applying the Environmental Management System in the Province of Zambales,**"** investigates the influence of Environmental Management System (EMS) implementation on environmental performance and sustainable mining outcomes among mining operations in the Province of Zambales, Philippines. The research was undertaken in response to growing concerns regarding the environmental, social, and economic impacts of mining activities, including ecosystem degradation, pollution, resource depletion, and community-related issues. Specifically, the study evaluates EMS implementation in terms of environmental policy compliance, environmental planning and risk assessment, monitoring and evaluation procedures, and employee environmental training and awareness. Environmental performance was assessed through waste management effectiveness, water quality protection, air pollution control, and land rehabilitation and biodiversity conservation. Sustainable mining outcomes were measured based on environmental sustainability, community well-being and social acceptance, economic viability, regulatory compliance, and corporate reputation. A descriptive-correlational research design was employed, utilizing structured survey questionnaires administered to mining personnel, regulatory agency representatives, and community stakeholders. Data were analyzed using descriptive statistical tools, including frequency, weighted mean, and standard deviation, as well as inferential statistical techniques such as correlation and regression analyses to determine the relationships among the study variables. The findings reveal that EMS implementation is generally effective across participating mining operations and significantly contributes to improved environmental performance. Results further indicate that environmental performance has a strong positive influence on sustainable mining outcomes, demonstrating that effective waste management systems, enhanced water and air quality protection measures, and successful land rehabilitation initiatives directly support long-term environmental sustainability, community acceptance, regulatory compliance, and organizational credibility. Moreover, environmental performance was found to serve as a significant mediating mechanism through which EMS practices translate into broader sustainability outcomes. The study concludes that EMS is a critical strategic tool for strengthening environmental governance, operational accountability, and sustainable resource management. Consequently, the study proposes an integrated Sustainable Mining Framework that emphasizes strengthened policy enforcement, continuous environmental monitoring, stakeholder participation, and adaptive sustainability strategies to promote responsible and resilient mining development in the Province of Zambales.

Keywords: Environmental Management System (EMS), Sustainable Mining, Environmental Performance, Environmental Governance, Zambales Province