

Development of an integrated risk assessment framework for future oil-contaminated land management. A complementary approach to sustainability.

Case study: Rivers State, Niger Delta, Nigeria.

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Abstract

The study proposed a comprehensive decision support framework (DSF) to integrate social considerations into decision-making processes for enhanced contaminated land management in Nigeria. This framework addresses the complex interplay between social, economic, and environmental factors, often overlooked in traditional remediation strategies. By incorporating multicriteria decision analysis (MCDA), the study effectively calculated total social, economic, and environmental indexes. These indexes were aggregated to derive a sustainability score for each remediation option, enabling a more balanced evaluation of the potential long-term impacts.

Social, economic, and environmental criteria were assessed as benefits or costs based on their impact on sustainability. This holistic approach considers impacts on community wellbeing, ecological restoration, and economic viability. Stakeholder input was key to scoring and weighting the criteria, ensuring the process reflects the needs and experiences of those directly affected by contamination and remediation efforts.

Phytoremediation emerged as the most beneficial, with a positive sustainability score (1.45). This option stood out for its ability to deliver tangible benefits to the environment and the local community. Phytoremediation involves using plants to clean up contaminated sites, offering a cost-effective and ecologically sound solution with added social benefits such as improved air and soil quality. In contrast, RENA (Remediation with enhanced natural attenuation) and NRA (no remedial action) scored (-3.9) and (-6.12) respectively. RENA scored lower due to its emphasis on environmental aspects and neglect of social impacts, rendering it less beneficial to the community. Taking no remedial action (NRA) would negatively impact the people and their environment, making it the worst-case scenario.

The positive sustainability index obtained for Phytoremediation emphasises the importance of including social criteria in contaminated land management decisions.

The proposed frameworks acknowledge the importance of considering the impacts of remediation efforts on local communities by prioritising social criteria alongside environmental and economic factors. This approach can lead to more holistic and inclusive decision-making processes that consider the needs and concerns of affected stakeholders. Furthermore, an integrated DSF can enhance remediation efforts' effectiveness and long-term viability. Addressing social issues such as healthcare, education, housing, and human security, the frameworks can contribute to the overall wellbeing of communities impacted by contamination. This, in turn, can lead to greater acceptance and support for remediation initiatives, fostering collaboration and cooperation among stakeholders. An integrated DSF improves the long-term sustainability of remediation by aligning environmental, social, and economic goals. It helps manage contamination and strengthens social cohesion, economic stability, and public health. The framework encourages stakeholder collaboration, driving a shared commitment to sustainable outcomes.

Finally, the DSF for contaminated land management in Nigeria can promote more comprehensive and sustainable solutions that benefit the environment and the people living in affected areas.