TRIM4PostMining Project

Transition Information Modelling for Attractive Post-Mining Landscapes

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Who We Are

TECHNISCHE UNIVERSITÄT BERGAKADEMIE FREIBERG
Die Ressourcenuniversität. Seit 1765.

TU Delft

Technische Hochschule Georg Agricola

SPECTRAL INDUSTRIES

MIBRAG

ROYAL Eijkelkamp
Meet the difference

beak CONSULTANTS

This project has received funding from the Research Fund for Coal and Steel under grant agreement No 899278

What We Want to Do

TRIM4PostMining brings together a consortium of European experts from industry and academia to **develop an integrated information modelling system**.

This is **designed to support decision making and planning** during the **transition from coal exploitation to a re-vitalized post-mining landscapes** enabling infrastructure development for agricultural and industrial utilization and also to contribute to recover energy and materials from coal mining dumps.

Source: MIBRAG CI

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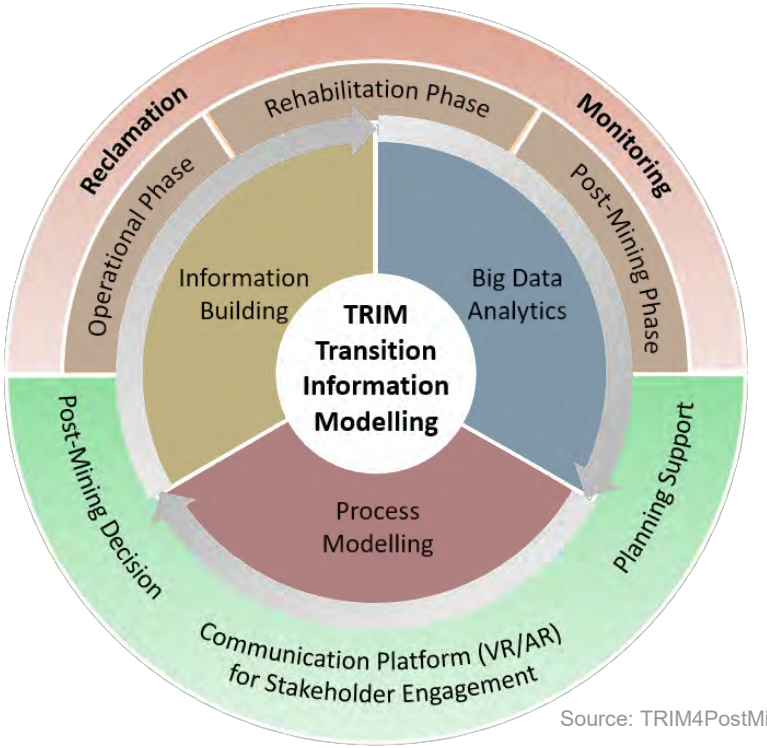
How We Want to Develop the Project

Creating an **integrated information modelling system** that supports decision making and planning **allowing for efficient and transparent communication between all key stakeholders.**

Founded up on a **high-resolution spatio-temporal data base utilizing multi-scale and multi-sensor technologies** to characterize dynamical processes in waste dumps related to timely dependent **deformation and geochemical processes**.

Furthermore, developing efficient methods for **spatial-temporal data analytics, and predictive modelling to identify and zoning potential risks areas and forecast behaviors.**



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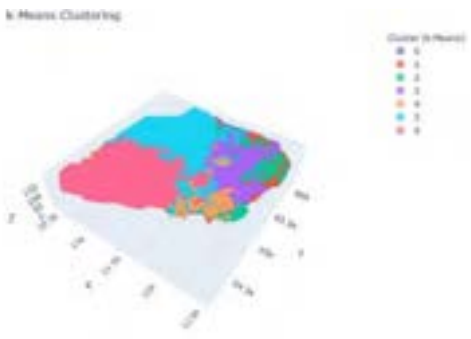
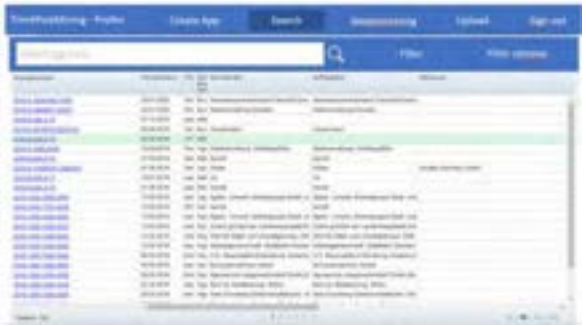
Project Interests

Remote Sensors Monitoring *(Revitalization Monitoring)*



Data Analytics and Modelling *(Data Driven Predictive Modelling)*

Data Management *(Revitalization Planning)*



Visualization Tools *(Revitalization Planning)*

Sources: TRIM4PostMining
www.hiphen-plant.com (Modified)
www.washington.edu

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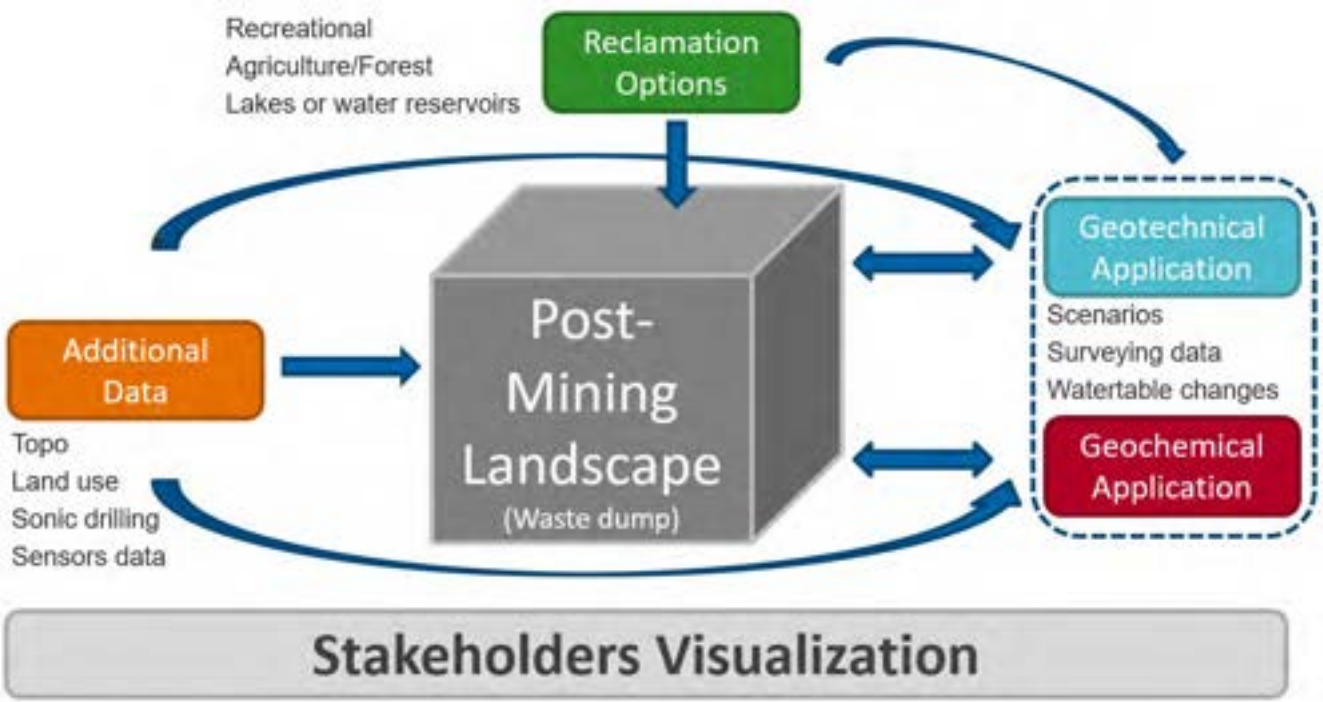
Project Approach



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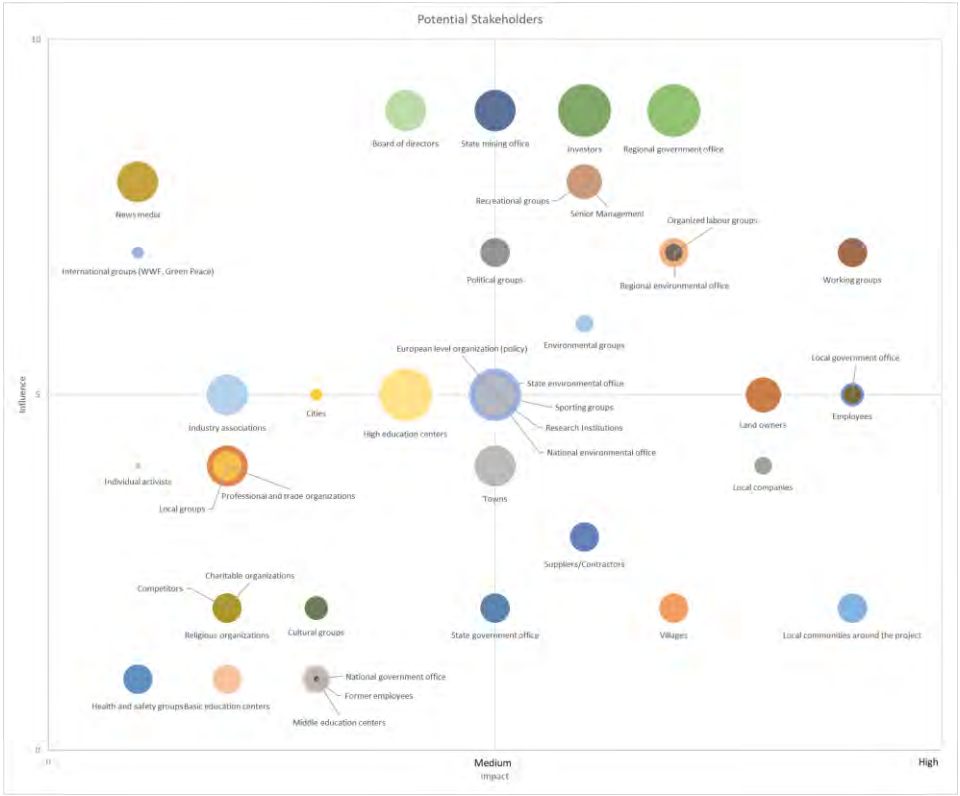
Decision Support System

Which essentially is a **system that brings together data and knowledge from different areas and sources** was developed after an stakeholder identification and assessment, to gather expectations and requirements for the project.

Obtaining 3 main groups and 42 potential stakeholders

- General Public
- Authorities
- Experts



Matrix for stakeholders identification.

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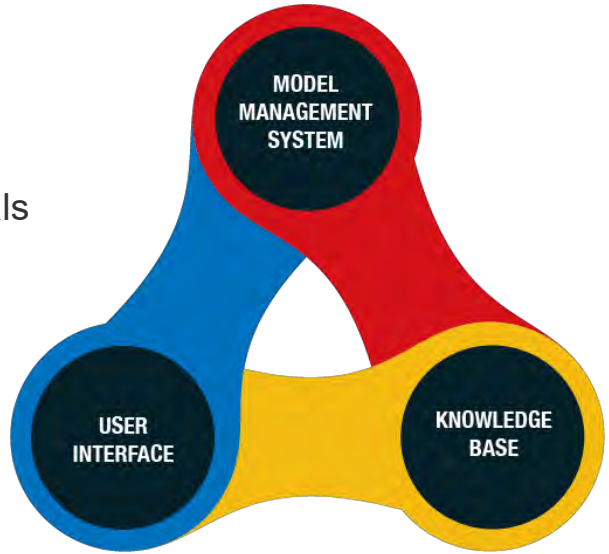
Decision Support System

Indicators

- Deformation Potential
  - Liquefaction
  - Settlement
- Geochemical Potential
  - Acidification
  - Toxic heavy metals



Reclamation Options

- Agriculture
- Forestry
- Water Reservoirs
- Recreation
- Civil Development
- Utilities and Services

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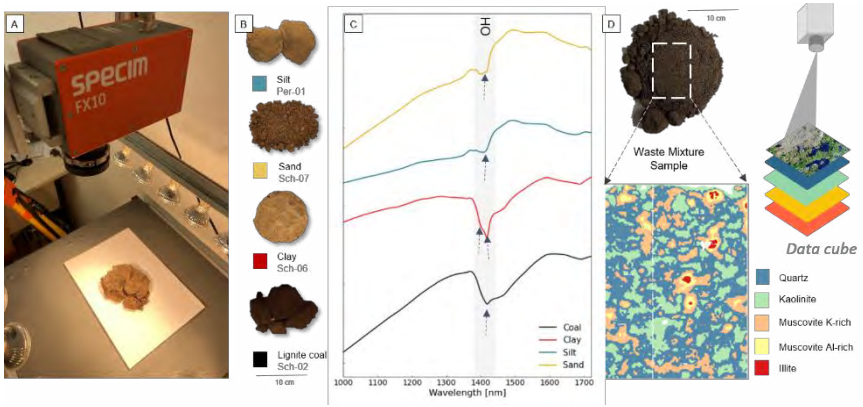
Material Characterization

Key geological attributes can be identified using remote sensors like,

LIBS (Laser-induced breakdown spectroscopy)
FTIR (Fourier-transform Infrared spectroscopy)
HX (Hyperspectral imaging)
Satellite data (Sentinel 1-2 program)
RGB imagery analysis

Methodological approaches are in development for the identification, and classification of materials within the mining waste, furthermore, we are able to detect **rare-earth elements, toxic heavy metals, acid-generating compounds, and grain size distributions.**



Upper image. ATR spectra of common materials. Lower Image, LIBS sensor
Lower image. Hyperspectral acquisition and processing

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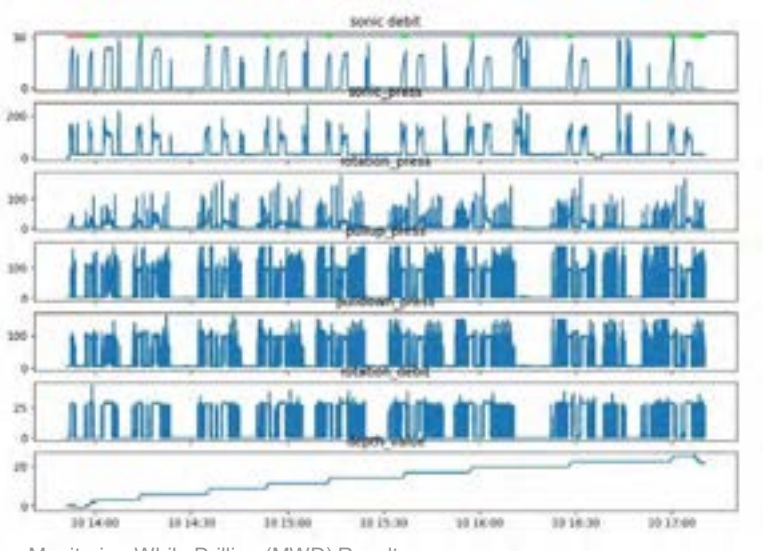
Material Characterization

To verify the remote sensors results of the waste dump analysis, two Sonic Drillings were performed to recover undisturbed cores combined with CPT data. Additionally, XRD and XRF are being applied to core samples.



Monitoring While Drilling (MWD) Results

Sonic Drilling at project site

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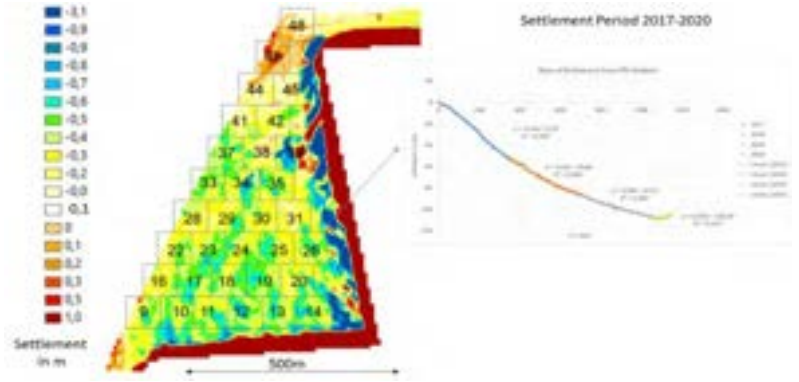
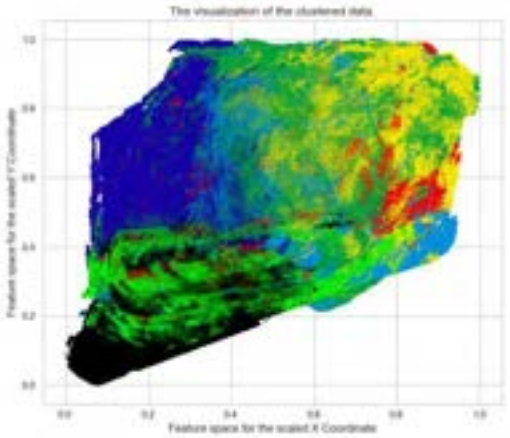
Geotechnical Modelling

A comprehensive analysis of ground movement data and liquefaction potential from different **data types (satellite based InSAR, airborne photogrammetry and laser scanning)** is being performed.



The analysis has been supported by a clustering approach of waste dump materials and selection of key variables which can be integrated in the visualization tools and decision-making process.



Upper image. Illustration of the analysis of ground movement data.
Lower image. Clustered dump site model

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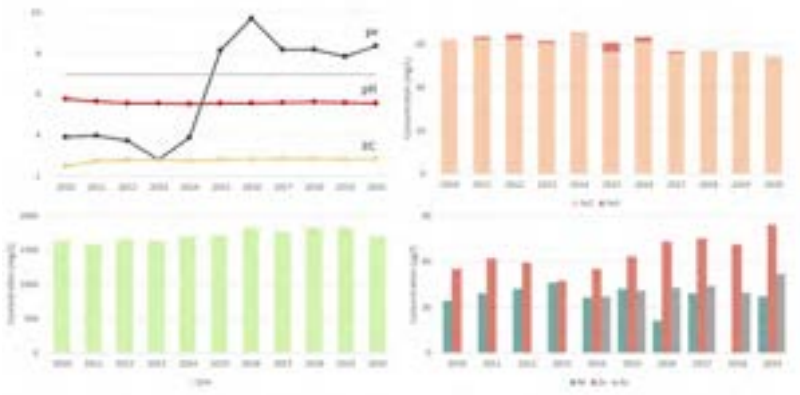
Geochemical Modelling

A **statistical geochemical data analysis** is being performed on available groundwater multi-temporal records and mineralogical characterization.

Relation between dumped materials, chemical reactions, and acidification potential is under modelling.



Upper image. Evolution of groundwater parameters.
Lower Image, Sample preparation for geochemical parameters.

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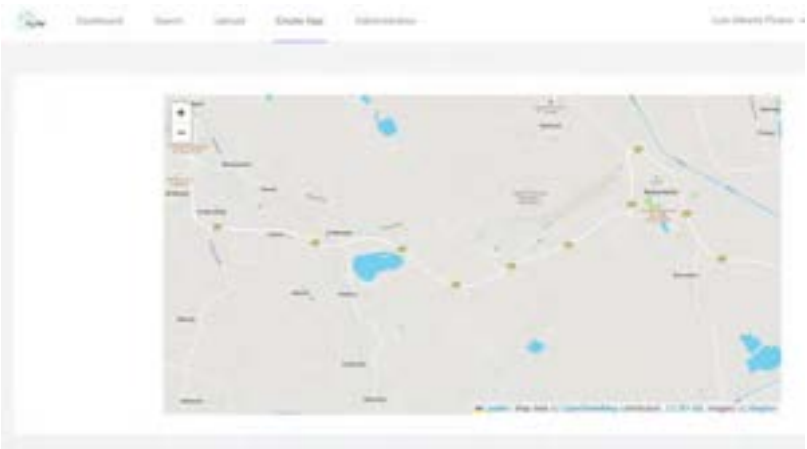
Data Mgmt. and Visualization Tools

Implement interfaces for the database system, and their interaction with **future applications (desktop, website, mobile devices).**



Left image. Interface into the database
Right Image, Example of AR application

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Next Steps

- Integration of geochemical and geotechnical modelling results and remote sensors characterization products into the visualization tools, developing the transition information modelling
- Demonstration activities for different cases at the study case, applying the decision support system.

General view of the MIBRAG waste dump.

Project Video https://youtu.be/IRGGUFIsgDA

Open Source Paper https://doi.org/10.3390/mining2020014

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Thank you

Visit our website www.trim4postmining.com

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