# ABSTRAK

Sektor pertambangan berisiko menghasilkan limbah cair pencemar lingkungan, sehingga parameter kualitas air seperti *pH*, *Total Suspended Solid* (TSS), dan sianida bebas wajib diawasi ketat sesuai baku mutu. Pada studi kasus PT Citra Palu Minerals, pencatatan pemantauan masih mengandalkan lembar kerja manual yang memicu inefisiensi, lambatnya pencarian arsip, tingginya risiko kehilangan data, serta ketiadaan visualisasi terpusat. Untuk mengoptimalkan pengawasan, manajemen membutuhkan sistem peringatan dini guna memproyeksikan tren kualitas air. Mengingat adanya fluktuasi dan anomali data tambang akan rentan menghasilkan error jika hanya bergantung pada algoritma tunggal, maka diperlukan sebuah solusi inovatif berupa pengembangan sistem terpusat yang tidak sekadar mendigitalisasi pelaporan, melainkan juga mengintegrasikan fitur analitik prediktif adaptif untuk meminimalisasi kesalahan dan pendukung dalam pengambilan keputusan operasional.

Melalui pendekatan kuantitatif eksperimental, penelitian ini merancang sistem informasi web tersentralisasi dengan mengakuisisi data komprehensif melalui observasi, wawancara, serta pengumpulan dokumen laporan sekunder sebagai variabel analitik. Siklus pengembangan aplikasi dieksekusi melalui lima tahapan metode *GRAPPLE* yang dibangun di atas fondasi *framework AdonisJS* dan basis data *PostgreSQL*. Guna menghadirkan fitur peringatan dini, sistem mengimplementasikan analitik prediktif antara *Simple Linear Regression* dan *Simple Exponential Smoothing*. Dengan menyerap data latih dalam rentang waktu 10–14 hari ke belakang, sistem secara dinamis menyeleksi algoritma dengan *Mean Absolute Error* terendah guna menghasilkan basis proyeksi peramalan yang tervalidasi untuk esok hari.

Penelitian ini menghasilkan dashboard manajemen kualitas air tambang terpusat yang efektif mengatasi inefisiensi pencatatan manual melalui digitalisasi dan visualisasi data real-time. Kesempurnaan fungsionalitas sistem divalidasi melalui *Black Box Testing*, sementara *User Acceptance Test* membuktikan kepraktisannya dalam mempercepat akses arsip, mengamankan data, dan mengotomatisasi analisis. Pada aspek prediktif, komparasi model adaptif terbukti andal dimana *Simple Linear Regression* terbukti mendapatkan *error* yang kecil pada tren stabil, sedangkan *Simple Exponential Smoothing* optimal meredam anomali. Sebagai kontribusi utama, infrastruktur dinamis ini menjamin manajemen selalu memperoleh proyeksi kualitas air harian yang paling valid guna mendukung mitigasi lingkungan.

**Kata Kunci:** Dashboard Kualitas Air, Prediksi Adaptif, Simple Linear Regression, Simple Exponential Smoothing, GRAPPLE

# ABSTRACT

*The mining sector runs the risk of producing environmentally polluting liquid waste, so water quality parameters such as pH, Total Suspended Solid (TSS), and CN Free must be strictly monitored in accordance with quality standards. In the case study of PT Citra Palu Minerals, monitoring records still rely on manual spreadsheets, which triggers inefficiency, slow archive retrieval, high risk of data loss, and the absence of centralized visualization. To optimize supervision, management needs an early warning system to project water quality trends. Considering that fluctuations and anomalies in mining data will be prone to producing errors if relying solely on a single algorithm, an innovative solution is needed in the form of developing a centralized system that does not merely digitize reporting, but also integrates adaptive predictive analytic features to minimize errors and support operational decision-making.*

*Through an experimental quantitative approach, this research designs a centralized web information system by acquiring comprehensive data through observation, interviews, and the collection of secondary report documents as analytic variables. The application development cycle is executed through the five stages of the GRAPPLE method, built upon the foundation of the AdonisJS framework and PostgreSQL database. To provide an early warning feature, the system implements predictive analytics between Simple Linear Regression and Simple Exponential Smoothing. By absorbing training data over a span of the past 10–14 days, the system dynamically selects the algorithm with the lowest Mean Absolute Error to produce a validated forecasting projection basis for the next day.*

*This research produces a centralized mine water quality management dashboard that effectively overcomes the inefficiency of manual recording through digitalization and real-time data visualization. The perfection of the system's functionality is validated through Black Box Testing, while the User Acceptance Test proves its practicality in accelerating archive access, securing data, and automating analysis. In the predictive aspect, the adaptive model comparison proves reliable, where Simple Linear Regression is proven to obtain small errors in stable trends, while Simple Exponential Smoothing is optimal in dampening anomalies. As a main contribution, this dynamic infrastructure guarantees that management always obtains the most valid daily water quality projection to support environmental mitigation.*

***Keywords:*** *Water Quality Dashboard, Adaptive Prediction, Simple Linear Regression, Simple Exponential Smoothing, GRAPPLE*