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Evaluasi Kapasitas dan Strategi Alokasi Sumber Daya Pada Sistem Transportasi Drilling Mud : Studi Kasus PT. X
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INTISARI

Program pengeboran minyak oleh PT. X di tahun 2027 diproyeksikan menghasilkan limbah lumpur pengeboran (*drilling mud*) dengan volume sebesar 879.890 m^3. Lumpur ini harus diangkut menggunakan armada truk dari titik sumur yang tersebar di tiga area kerja, menuju lima Fasilitas Pengolahan Lumpur (FPL). Perusahaan menerapkan strategi *region-bound*, dan ingin mengevaluasi performanya dibandingkan dengan strategi *cross-border*. Penelitian ini bertujuan mengevaluasi kecukupan sistem eksisting perusahaan terhadap proyeksi volume pengeboran di tahun 2027, menentukan penambahan jumlah truk dan kapasitas FPL jika diperlukan, dan membandingkan performa strategi *cross-border* dengan strategi *region-bound*. Model *discrete event simulation* (DES) telah dikembangkan dan dijalankan melalui dua tahap *Design of Experiments* (DOE), yaitu penentuan konfigurasi truk dan kapasitas FPL terbaik, dan perbandingan strategi alokasi, kemudian pemilihan skenario terbaik dilakukan menggunakan *weighted scoring method*. Hasil menunjukkan sistem eksisting tidak mampu mengakomodasi volume 2027, dengan *service level* hanya 35,35%, dan volume lumpur tidak terangkut sebesar 568.820 m^3. Sistem memerlukan penambahan armada dari 39 menjadi 49 unit truk disertai peningkatan kapasitas di seluruh FPL, yang meningkatkan *service level* menjadi 99,62% dengan tetap menerapkan strategi *region-bound*. Strategi *region-bound* secara konsisten mengungguli strategi *cross-border* pada konfigurasi truk terbaik, karena fleksibilitas lintas area justru menimbulkan *resource drain* pada truk dan *problem shifting* pada lumpur. PT. X disarankan menambah armada disertai peningkatan kapasitas FPL sesuai karakteristik *bottleneck* tiap area, serta mempertahankan strategi *region-bound* dan menerapkan *cross-border* hanya sebagai mekanisme darurat.

Kata kunci : *drilling mud transportation, discrete event simulation, design of experiments*, *fleet sizing, fleet pooling*

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ABSTRACT

PT. X's 2027 oil drilling program is projected to generate drilling mud with an estimated volume of 879.890 m^3 in 2027. This drilling mud must be transported using a truck fleet, from wells dispersed across three working areas to five mud treatment facilities (FPL). The company applies a region-bound strategy, and want to evaluate the performance against a cross-border strategy. This research aims to evaluate the adequacy of the existing system against the 2027 drilling mud volume projection, determine the required addition of trucks and FPL capacity, and compare the performance of the cross-border strategy with the region-bound strategy. A discrete event simulation (DES) model was developed and designed through two stages of Design of Experiments (DOE), namely the determination of the best configuration of fleet size and FPL capacity, and the comparison of allocation strategies, and then the best scenario is selected through a weighted scoring method. The results show that the existing system is unable to accommodate the 2027 volume, with a service level of only 35,35% and unserved mud amounting to 568.820 m^3. The system requires a fleet expansion from 39 to 49 trucks along with capacity improvements across all FPLs, which raises the service level to 99,62% while retaining the region-bound strategy. The region-bound strategy consistently outperforms the cross-border strategy under the best fleet configuration, as cross-area flexibility instead induces resource drain on the trucks and problem shifting on the drilling mud. PT. X is advised to expand its fleet along with FPL capacity improvements according to the bottleneck characteristics of each area, while maintaining the region-bound strategy and applying cross-border allocation only as an emergency mechanism.

Keywords : *drilling mud transportation, discrete event simulation, design of experiments, fleet sizing, fleet pooling*