PERANCANGAN MODEL HUB DENGAN PENDEKATAN SIMULASI UNTUK OPTIMASI BIAYA OPERASIONAL *WAREHOUSE* DI PT. X

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ABSTRAK

Penelitian ini bertujuan untuk mengoptimalkan biaya operasional *warehouse* PT. X di Zona 4 (Prabumulih, Pendopo, Adera, Limau, Ramba) melalui perancangan model hub menggunakan metode P-Median, analisis ABC, Simulasi Monte Carlo, dan *Total Cost Analysis Framework*. Hasilnya menunjukkan bahwa model hub Prabumulih-Ramba mampu menurunkan total biaya operasional sebesar 44.99%, dari $4,172,372.72 menjadi $2,295,115.00. Biaya peralatan turun $1,084,994.22 dan konsumsi bahan bakar berkurang $792,263.49, dengan jumlah *purchase order* yang dikonsolidasi dari 132 PO menjadi 59 PO. Simulasi Monte Carlo membuktikan hasil distribusi probabilistik biaya operasional P50 sebesar $877,314.66 untuk *equipment* dan $640,615.56 untuk *fuel consumption*. Analisis sensitivitas menunjukkan bahwa dalam beberapa skenario inflasi, dengan nilai inflasi tertinggi terhadap biaya operasional dari 44.99% menjadi 38.76%, namun model ini tetap lebih efisien dibanding kondisi awal. Dengan demikian, diharapkan strategi yang digunakan dalam konsolidasi *warehouse* berbasis hub dapat menjadi solusi efektif dalam menurunkan biaya operasional PT. X.

Kata kunci: *Optimasi, P-Median, Simulasi Monte Carlo, Total Cost Analysis, Warehouse*

HUB MODEL DESIGN USING A SIMULATION APPROACH TO OPTIMIZE WAREHOUSE OPERATIONAL COSTS AT PT. X

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ABSTRACT

This research aims to optimize warehouse operational costs of PT. X in Zone 4 (Prabumulih, Pendopo, Adera, Limau, Ramba) through hub model design using P-Median method, ABC analysis, Monte Carlo Simulation, and Total Cost Analysis Framework. The results show that the Prabumulih-Ramba hub model can reduce total operational costs by 44.99%, from $4,172,372.72 to $2,295,115.00. Equipment costs decreased by $1,084,994.22 and fuel consumption reduced by $792,263.49, with the number of purchase orders consolidated from 132 POs to 59 POs. Monte Carlo simulation verified the probabilistic distribution of operational costs with P50 values of $877,314.66 for equipment and $640,615.56 for fuel consumption. Sensitivity analysis indicates that under various inflation scenarios, with the highest inflation impact on operational cost savings from 44.99% to 38.76%, this model remains more efficient compared to the initial condition. The strategy used in hub-based warehouse consolidation demonstrates an effective solution in reducing PT. X's operational costs.

Keywords: *Monte Carlo Simulation, Optimization, P-Median, Total Cost Analysis, Warehouse*