

INTISARI

Tingginya populasi unit *Articulated Dump Truck* (ADT) dalam operasi pertambangan berdampak pada besarnya biaya pemeliharaan, khususnya komponen *tyre* yang rentan mengalami kegagalan prematur akibat kondisi medan ekstrem. Metode konvensional perusahaan dalam mengestimasi umur *tyre* rentan menimbulkan bias karena mengabaikan data tersensor, sehingga menuntut adanya evaluasi komprehensif berbasis keandalan dan finansial. Penelitian ini bertujuan merumuskan rekomendasi strategi pengadaan (*plan order*) *tyre* yang optimal melalui integrasi metode Kaplan-Meier dan *Life Cycle Cost* (LCC) untuk mendukung efisiensi biaya operasional. Pendekatan deskriptif komparatif diterapkan dengan menganalisis data historis perbaikan *tyre* ADT periode Januari 2023 hingga Desember 2025 menggunakan estimator nonparametrik Kaplan-Meier, uji komparasi *Log-Rank*, dan perhitungan parameter *Cost Per Hour* (CPH) berbasis LCC. Analisis Kaplan-Meier dan uji *Log-Rank* membuktikan bahwa *tyre* Merek A (MST 2.790 HM) dan Merek B (MST 2.840 HM) memiliki ketahanan fisik dan probabilitas kegagalan yang setara secara statistik. Namun, evaluasi LCC menunjukkan Merek A terbukti 3,55% lebih efisien dengan CPH sebesar Rp25.511/HM dibandingkan Merek B yang mencapai Rp26.449/HM. Metode integrasi ini juga berhasil membongkar beban *hidden cost* rata-rata sebesar Rp331.992.000/tahun yang selama ini tidak terdeteksi oleh metode perusahaan. Substitusi umur keandalan ini ke dalam formulasi *forecasting* logistik, dikombinasikan dengan perhitungan *safety stock* berbasis statistik (4 pcs), terbukti mampu mengeliminasi proyeksi pesanan berlebih (*overforecasting*). Kerangka pengadaan terintegrasi ini tervalidasi sebagai instrumen manajerial presisi yang mampu mencegah pemborosan akibat penumpukan aset (*overstock*), menghasilkan rata-rata optimasi anggaran sebesar 10,78%, dan mampu mengoptimalkan biaya pengadaan hingga Rp1.634.400.000 pada kapasitas operasional maksimum.

Kata Kunci: Kapan-Meier, *Life Cycle Cost*, *Cost Per Hour*, *Tyre*, *Forecasting*

ABSTRACT

The high population of Articulated Dump Truck (ADT) units in mining operations significantly impacts maintenance costs, particularly for tyre components, which are susceptible to premature failure due to extreme terrain conditions. The company's conventional method for estimating tyre life is prone to bias as it ignores censored data, necessitating a comprehensive evaluation based on reliability and financial aspects. This study aims to formulate optimal tyre procurement strategy (plan order) recommendations through the integration of the Kaplan-Meier method and Life Cycle Cost (LCC) to support operational cost efficiency. A comparative descriptive approach was applied by analyzing historical ADT tyre maintenance data from January 2023 to December 2025 using the nonparametric Kaplan-Meier estimator, Log-Rank comparative test, and LCC-based Cost Per Hour (CPH) parameter calculations. The Kaplan-Meier analysis and Log-Rank test proved that Brand A (MST 2,790 HM) and Brand B (MST 2,840 HM) tyres possess statistically equivalent physical durability and failure probabilities. However, the LCC evaluation indicated that Brand A is proven to be 3.55% more efficient with a CPH of Rp25,511/HM compared to Brand B, which reached Rp26,449/HM. This integrated method also successfully uncovered an average hidden cost burden of Rp331,992,000/year, which had previously been undetected by the company's method. Substituting this reliability life into the logistics forecasting formulation, combined with statistically based safety stock calculations (4 pcs), has proven capable of eliminating overforecasting projections. This integrated procurement framework is validated as a precise managerial instrument capable of preventing financial waste due to asset accumulation (overstock), generating an average budget optimization of 10.78%, and optimizing procurement costs by up to Rp1,634,400,000 at maximum operational capacity.

Keywords: Kaplan-Meier, Life Cycle Cost, Cost Per Hour, Tyre, Forecasting